To determine the incidence of complications associated with the use of Glidescope Video-Laryngoscope (GVL) in patients with anticipated difficult airway management.

A dissertation submitted to the Tamil Nadu Dr. M.G.R. Medical University: in partial fulfilment of the requirement for the M.D. Branch X (Anesthesiology) examination held in April 2016.

BONAFIDE CERTIFICATE

This is to certify that the dissertation entitled ″ To determine the incidence of complications associated with the use of Glidescope Video-Laryngoscope (GVL) in patients with anticipated difficult airway management" is a bonafide work done by Dr. Mary Benita Jeyakumar, Christian Medical College,Vellore, during the academic year 2013-2016, under my guidance, in partial fulfilment of the Tamil Nadu Dr. MGR Medical University rules and regulations towards the MD anesthesiology exam (Branch-X) to be held in April 2016.

Signatures:

Guide:	**Headof department:**	**Principal:**
Dr. Tony T Chandy,	Dr. Sajan Philip George,	Dr. Alfed Job Daniel,
Professor,	Professor,	Christian Medical College,
Anesthesiology,	Anesthesiology,	Vellore-632002.
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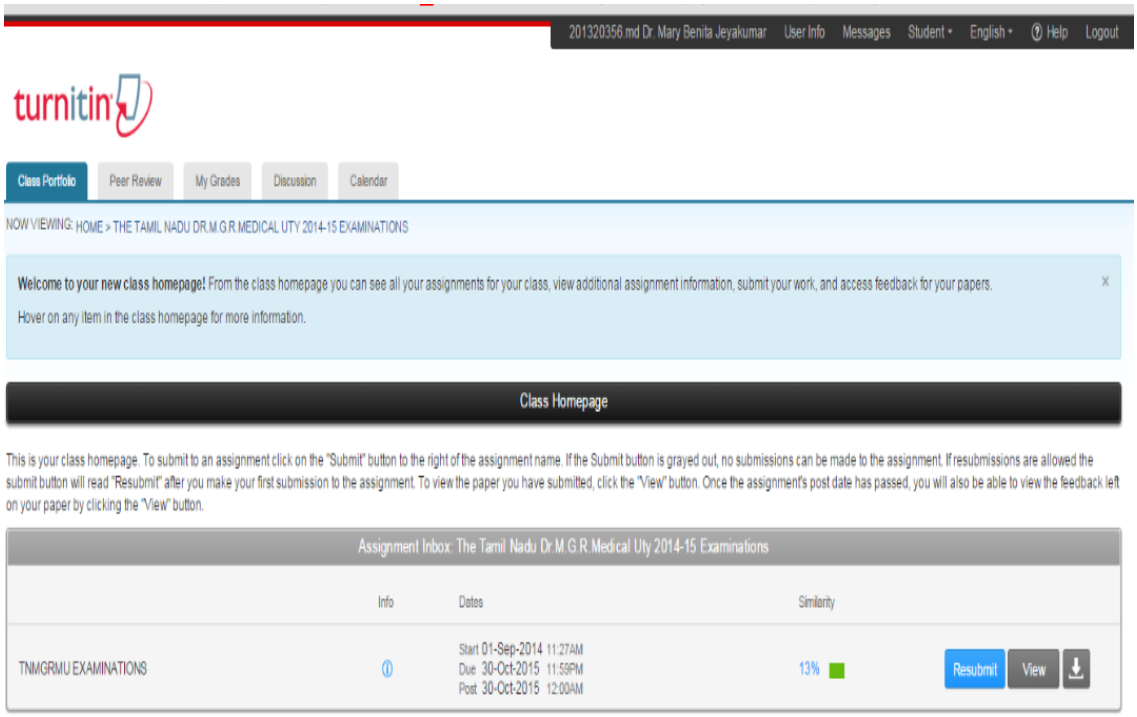

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PG Registrar
Department of Anesthesiology
Christian Medical College, Vellore 632 004

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To determine the incidence of complications associated with the use of Glidescope Video-Laryngoscope (GVL) in patients with anticipated difficult airway management.
Dr. Mary Benita Jeyakumar, PG Registrar, Dr. Tony T Chandy, Dr. Karen Ruby Lionel, Anesthesiology, Ms. Grace Rebekah. J, Biostatistics, CMC, Vellore.

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Institutional Review Board,
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Name	Qualification	Designation	Other Affiliations
Dr. Chandra Singh	MS, MCH, DMB	Professor, Urology, CMC.	Internal, Clinician
Dr. Vivek Mathew	MD (Gen. Med.) D.M (Neuro) Dip. NB (Neuro)	Professor, Neurology, CMC, Vellore	Internal, Clinician
Dr. Simon Pavamani	MBBS, MD,	Professor, Radiotherapy, CMC, Vellore	Internal, Clinician
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Dr. Anuradha Rose	MBBS, MD	Assistant Professor, Community Health, CMC, Vellore	Internal, Clinician

Ethics Committee Blue, Office of Research, 1st Floor, Carman Block, Christian Medical College, Vellore, Tamil Nadu 632 002.
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MD., MNAMS., DNB (Endo), FRACP (Endo), FRCP (Edin), FRCP (Glasg)
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Tel : 0416 - 2284201, 2284202 Fax :0416 - 2262788, 2284481 E-mail : research@cmcvellore.ac.in

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I express my gratitude to all my friends and family who supported me with their prayers.

CONTENTS

ABSTRACT

TITLE:

To determine the incidence of complications associated with the use of Glidescope Video-Laryngoscope (GVL) in patients with anticipated difficult airway management

OBJECTIVES:

To estimate the incidence of complications with the use of GVL by experienced anesthesiologists, in patients with anticipated difficult airway. To identify associated factors in patients with complicated GVL intubations.

METHODS:

89 adult patients with anticipated difficult airway were intubated using GVL by experienced anesthesiologists. The incidence of trauma was estimated and associated factors in the trauma subset were analysed.

RESULTS:

The incidence of trauma was estimated to be 11.2%. All of them were minor injuries that were managed conservatively. The incidence of trauma was less when intubated by more experienced anesthesiologists ($p=0.02$). The incidence of trauma was more in the patients with Arne score of ≥ 11. ($p=0.05$) and in the group who had difficult GVL scopy ($p=0.00$).

CONCLUSIONS:

The incidence of airway trauma can be reduced with strict adherence to the specifications of GVL scopy technique.

INTRODUCTION

Video-laryngoscopes are newer laryngoscopes which attempts to improve the success of intubation by using advanced technology to increase lighting and visualising an out of line of sight larynx(1) They were introduced to clinical practice since 2001 and offers the advantage of improved visualization of the glottis with minimal cervical spine movement and decreased force of application which results in lesser sympathetic response to intubation.(2)(3)(4).

Glidescope video-laryngoscope (GVL)is a fourth generation video-laryngoscope and is the equipment of interest in this study. The more acute angled blade along with the high resolution, antifogging camera accompanied by two light sources attached at the tip of the blade displays a well illuminated panoramic image of the glottis on the display monitor with much ease.(1)The earlier studies evaluating the efficacy of GVL confirm this fact by concluding that the time to visualise the glottis was quicker but the time to intubate was prolonged in comparison with direct laryngoscopy using macintosh.(5)

Recent evidence shows increasing incidence of airway trauma with GVL use. (6)(7)(8)(9) This evidence, in addition to the pre-existing knowledge of prolonged intubation times with GVL imposes a need for a search of the possible causes of airway trauma.

In this study, it is hypothesised that a lack of knowledge of the technique of use of GVL is the reason for increasing incidence of airwaytrauma. On estimating the incidence of airway trauma with the use of GVL by experienced anesthesiologists

(more than 3 years of experience in anesthesiology), a clear conclusion can be made. A significant incidence would mean that there are other reasons for airway trauma considering the knowledge of the experienced anesthesiologist regarding the use of GVL to be optimum.

OBJECTIVES

1. To estimate the incidence of complications with the use of GVL in patients with anticipated difficult airway by experienced anesthesiologists.
2. To identify associated factors in patients with complicated GVL intubations.

LITERATURE REVIEW

Safe insertion of the endotracheal tube is important in all medical specialities in order to prevent hypoxia. The importance of safe airway management is vital to anesthesia.

Safe practices which have a direct impact on outcome include :

(i) Complete history and physical examination of the airway.

(ii) Consideration of rapid sequence intubation

(iii) Alternative airway plans

(iv) Assessing the risk of developing aspiration pneumonitis

(v) Estimating the risk of failed airway management (10)

AIRWAY ANATOMY:

The term “airway” is the ordinary expression of the complex respiratory tract, formed by the upper respiratory tract and lower respiratory tract with the larynx in-between them. The nose, the nasal passages, the oral cavity, the tongue and the pharynx form the upper respiratory tract, while the trachea, the bronchi, the bronchioles and the alveoli form the lower respiratory tract. (11)

In order to establish a patent airway using Glidescope video-laryngoscope, knowledge of the upper airway anatomy is imperative.

Oral cavity

The oral cavity is composed of the vestibule on the outer aspect and the oral cavity proper on the inner aspect.

- ***The vestibule*** is a narrow space between the lips, cheeks, teeth and gums. It is lined by mucous membrane.
- ***The oral cavity proper***is larger than the vestibule. It has the teeth, the gums and the alveolar arches of the mandible fencing it anteriorly and laterally, the hard palate and the soft palate forming the roof and the tongue forming the floor. It communicates with the pharynx posteriorly through the isthmus of fauces. The sublingual region has the frenulum of the tongue and the sublingual papilla.
    - *The gums* are soft tissues covering the neck of the teeth and the alveolar processes of the mandible . The fibrous tissue of the gums continues into the periosteum of the alveoli of the mandible.

- *The hard palate* seperates the nasal cavity from the oral cavity. The palatine processes of maxilla and the horizontal plates of the palatine bones constitute the hard palate in the anterior two-third and posterior one third respectively. It roofs the oral cavity, floors the nasal cavity, extends anterolaterally into the alveolar arches and gums and attaches to the soft palate posteriorly.
- *The soft palate* is a mobile muscular band suspended from the posterior border of the hard palate. It demarcates the oropharynx from the nasopharynx. Anteriorly it is maked by the median raphe, posteriorly it continues as the floor of the nasal cavity, superiorly it is attached to the posterior border of the hard palate and inferiorly it bounds the pharyngeal isthmus. The muscles of the soft palate are tensor palati, levator palati, musculus uvulae, palatoglossus and palatopharyngeus.
- *The uvula* is a conical projection at the midline of the soft palate. It is made up of the musculus uvulae which is covered by mucosa.
- *The faucial pillars* are folds of mucous membrane which extend laterally and downwards from either side of the uvula. The anterior fold is called the *palatoglossal arch* or *anterior faucial pillar*. The posterior fold is called the *palatopharyngeal arch* or *posterior faucial pillar*. It contains the palatopharyngeus muscle. It forms the posterior boundary of the tonsillar fossa and merges anteriorly with the lateral wall of the pharynx.

- *The tongue* is a muscular organ in the mouth covered with mucosa. It is tethered to the floor of the mouth by the frenulum. Posteriorly it is attached to the hyoid bone. It has two parts: the oral part and the pharyngeal part. The two parts are demarcated by the sulcus terminalis. The mucosal surface of the tongue has many papillae and taste buds. It is made up of the intrinsic muscles which are the inferior and superior longitudinal muscles, the transverse and vertical muscles and the extrinsic muscles which are the genioglossus, styloglossus, palatoglossus and hyoglossus, help in the movement of the tongue enabling it to carry out the functions of mastication, deglutition and speech.

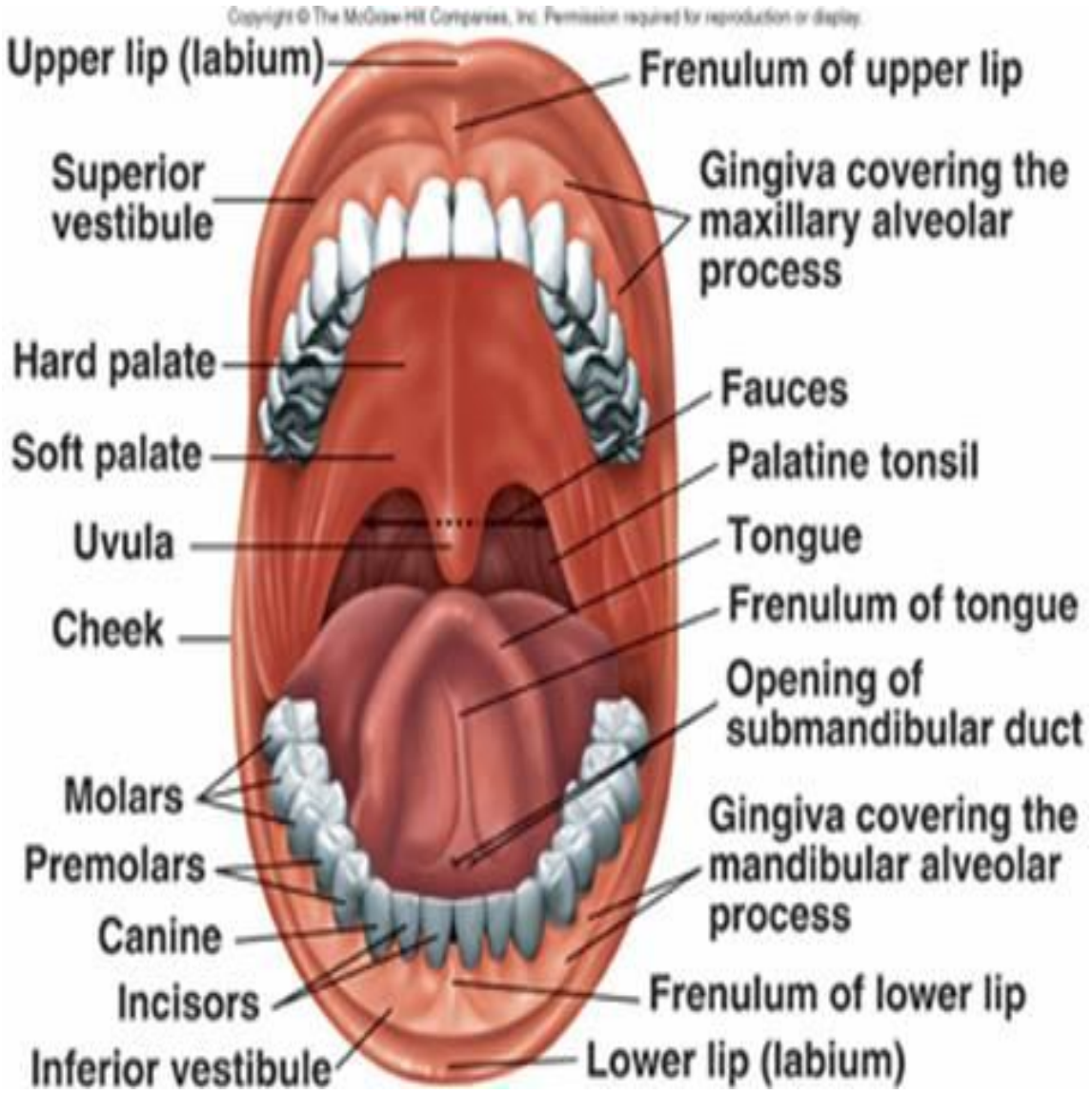

Figure 1 The Oral Cavity

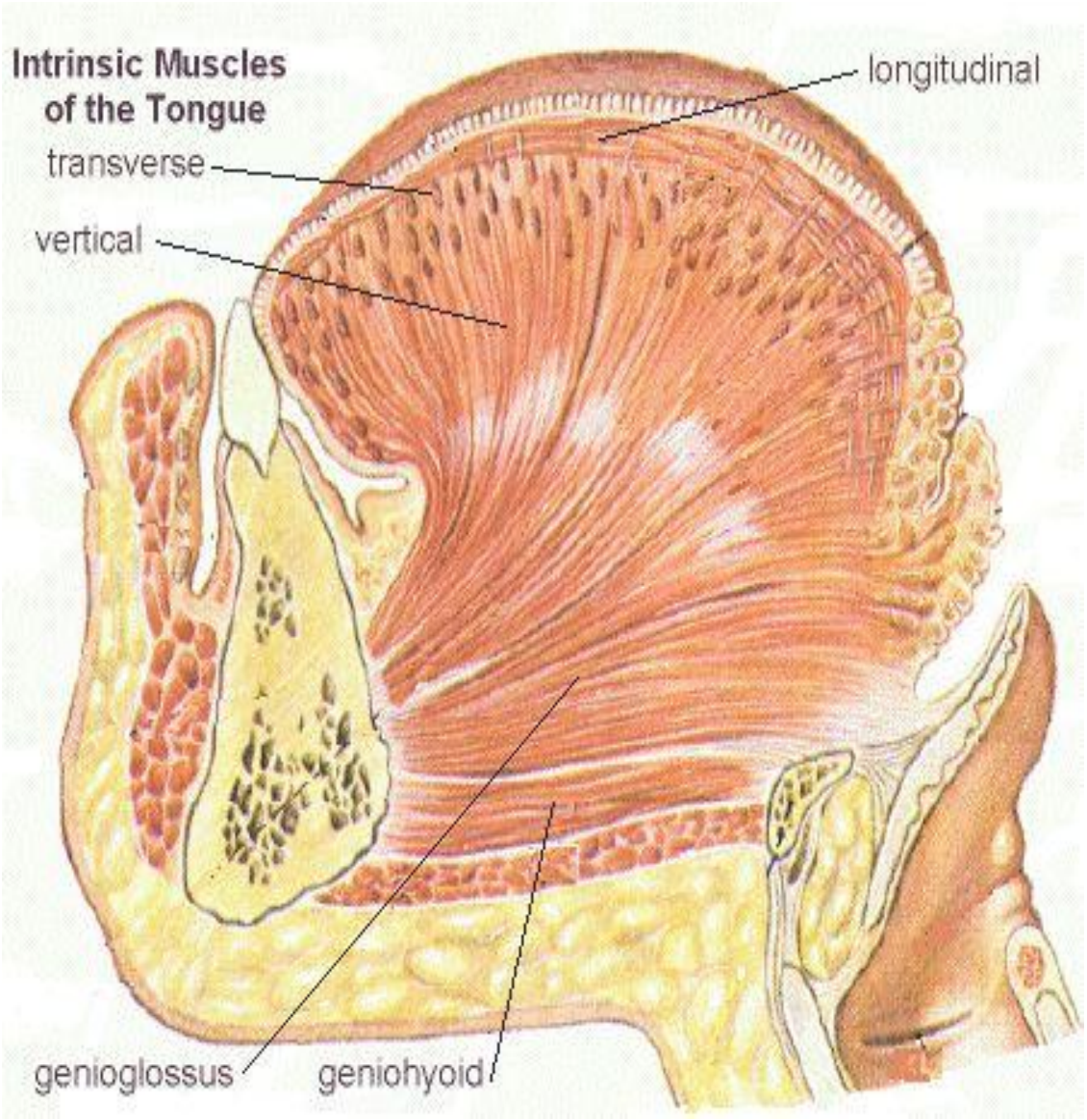

Figure 2 The cross section of the tongue

Pharynx

The pharynx is a wide region situated behind the nose, the mouth and the larynx. It is a common passage for both air and food. It is 12cm in length and has a funnel shape with the widest upper part measuring 3.5cm in width. It continues as the oesophagus inferiorly at the level of the 6^{th} cervical vertebra. The pre-vertebral fascia lies posterior to it and separates it from the cervical spine and anteriorly it communicates with the mouth, nose and the oral cavity. The cavity of the pharynx is divided into the naso-pharynx, the oro-pharynx and the laryngo-pharynx.

- ***The naso-pharynx***is non-collapsible to ensure the air passageis patent always. It communicates with the nasal cavities through the posterior nasal apertures anteriorly, the oro-pharynx at the pharyngeal isthmus inferiorly. Nasopharyngeal tonsils are present in the posterior wall and are called the adenoids.
- ***The oro-pharynx***is the mid-portion of the pharynx situated opposite the oral cavity where the food and the air passage cross. It communicates with the naso-pharynx superiorly and the laryngopharynx inferiorly. The lateral wall presents the palatine tonsil which lies in the tonsillar fossa. *The palatine tonsils* are lymphoid tissue aggreagtes that lie on each side of the pharynx. It has multiple tonsillar pits on the outer surface. The posterior wall is made up of the superior, middle and inferior constrictors of the pharynx.

- ***The laryngo-pharynx***extends from the epiglottis to the lower border of the cricoid at the level of C6. It has recesses on either side called the *piriform fossa*. Sharp foreign bodies such as fish bones tend to impact here. (12)

The pharynx is the region most prone for trauma from the tip of the laryngoscope during intubation. To prevent this, the tip of the laryngoscope has rounded edges.

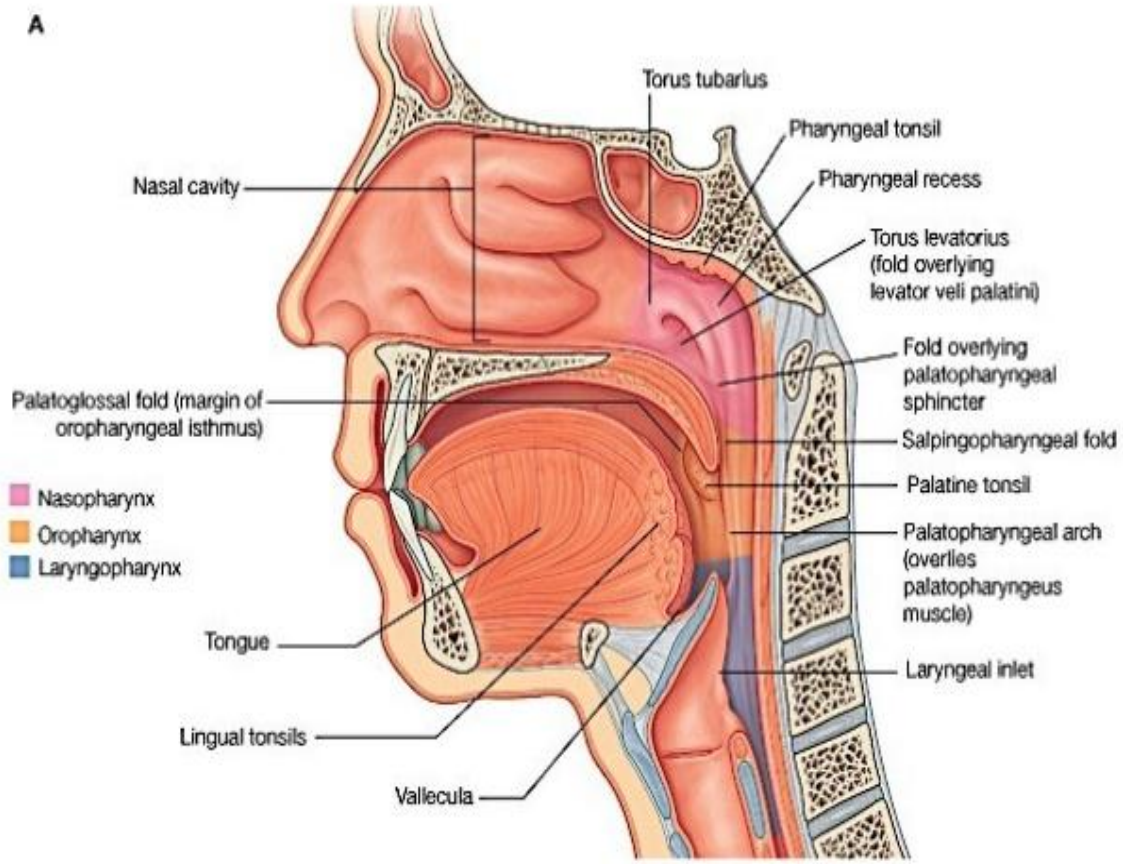

Figure 3. Pharynx- lateral view

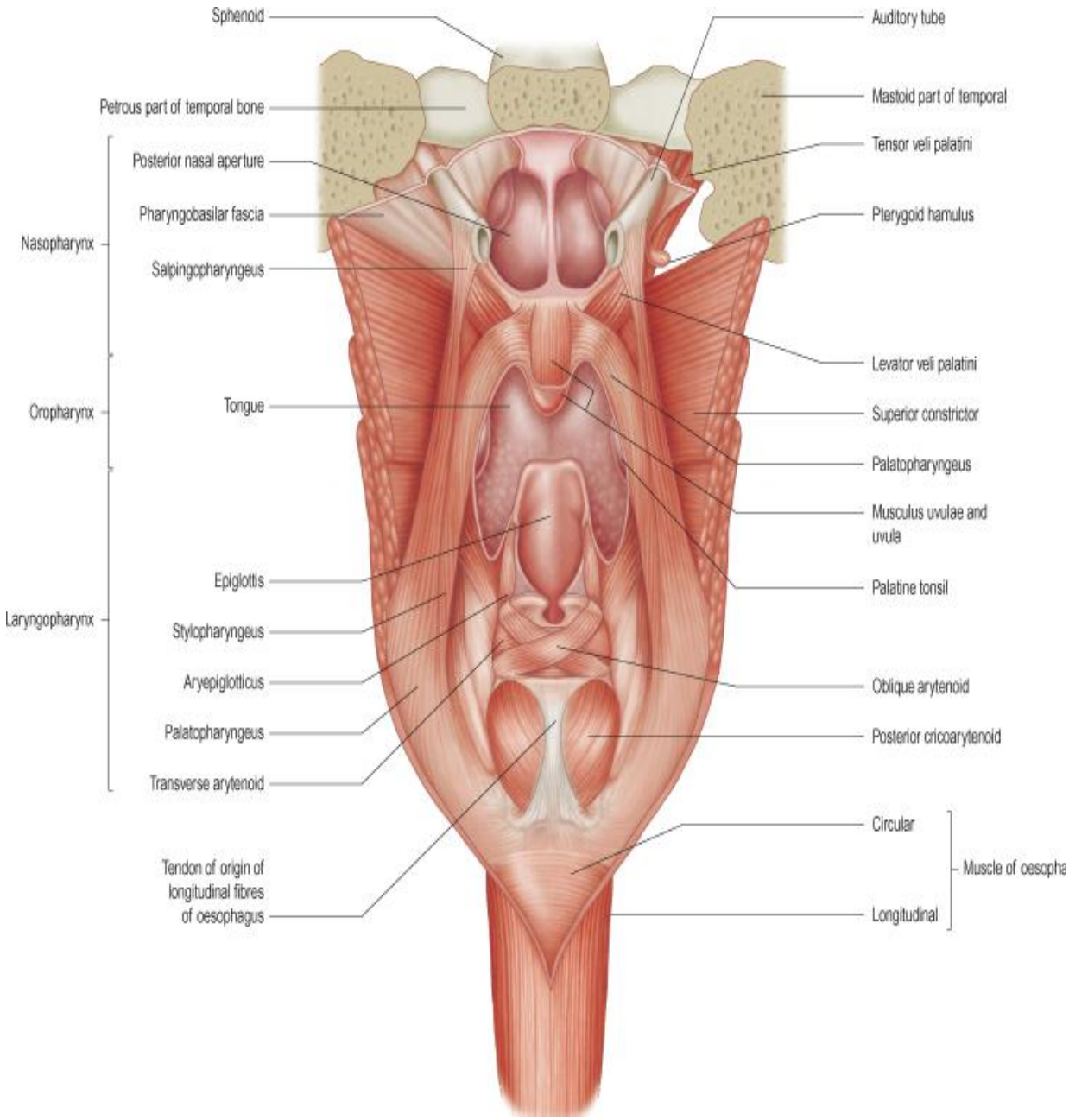

Figure 4. Pharynx

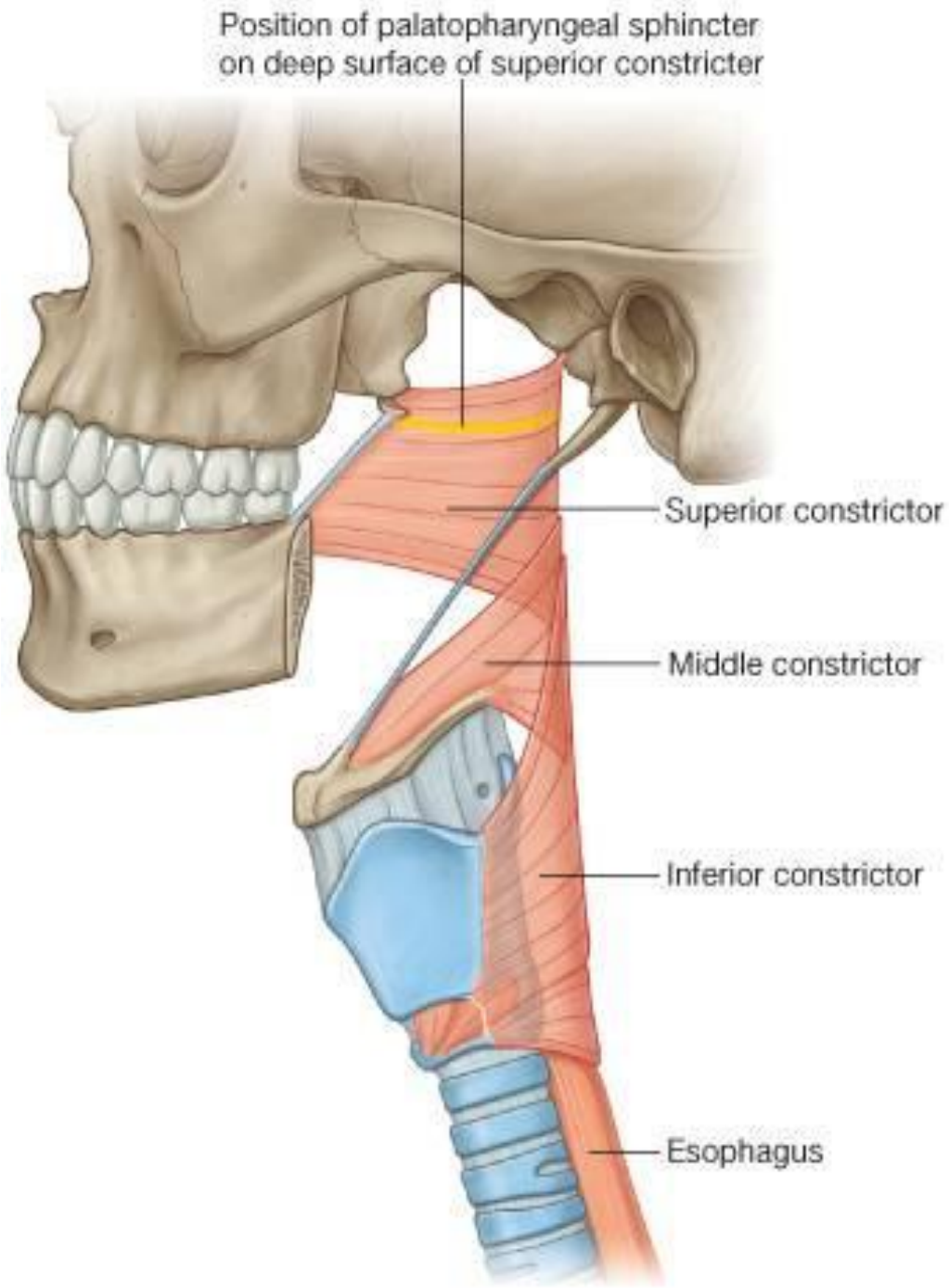

Figure 5 The Pharyngeal muscles

Larynx

The larynx is a protective valve at the upper respiratory tract; it also helps in phonation.Structurally, the larynx is a co-ordination of articulating cartilages, linked together by ligaments, and laryngeal muscles. It lies opposite the C_4-C_6 vertebra.

- ***The laryngeal cartilages***are the unpaired thyroid, cricoid and epiglottis and the paired arytenoids, corniculate and cuneiform cartilages.
    - *The thyroid cartilage*is butterfly shaped with two laminae that meet in the midline. There is a thyroid notch that is palpable. It forms the laryngeal prominence or Adam's apple in the males.
    - *The cricoid cartilage*is ring shaped cartilage. It articulates with the thyroid and the arytenoid cartilages.
    - *The arytenoid cartilages*are pyramid shaped and articulate with cricoid cartilage..
    - *The epiglottis*is leaf- like. The narrow end is attached to the thyroid cartilage by the thyro-epiglottic ligament. It hangs in the laryngeal inlet. It is covered by mucous menmbrane. It has troughs on either side of the median glosso-epiglottic fold called the *valleculae*;. The lower part of the anterior surface of the epiglottis is attached to the back of the hyoid bone by the hyo-epiglottic ligament. In the neonate, the epiglottis is long, deeply-grooved and 'floppy and causes difficult intubation.
    - *The corniculate cartilage*lies at the apex of the arytenoid.
    - *The cuneiform cartilage*is a crumb of cartilage along the margin of the aryepiglottic fold.

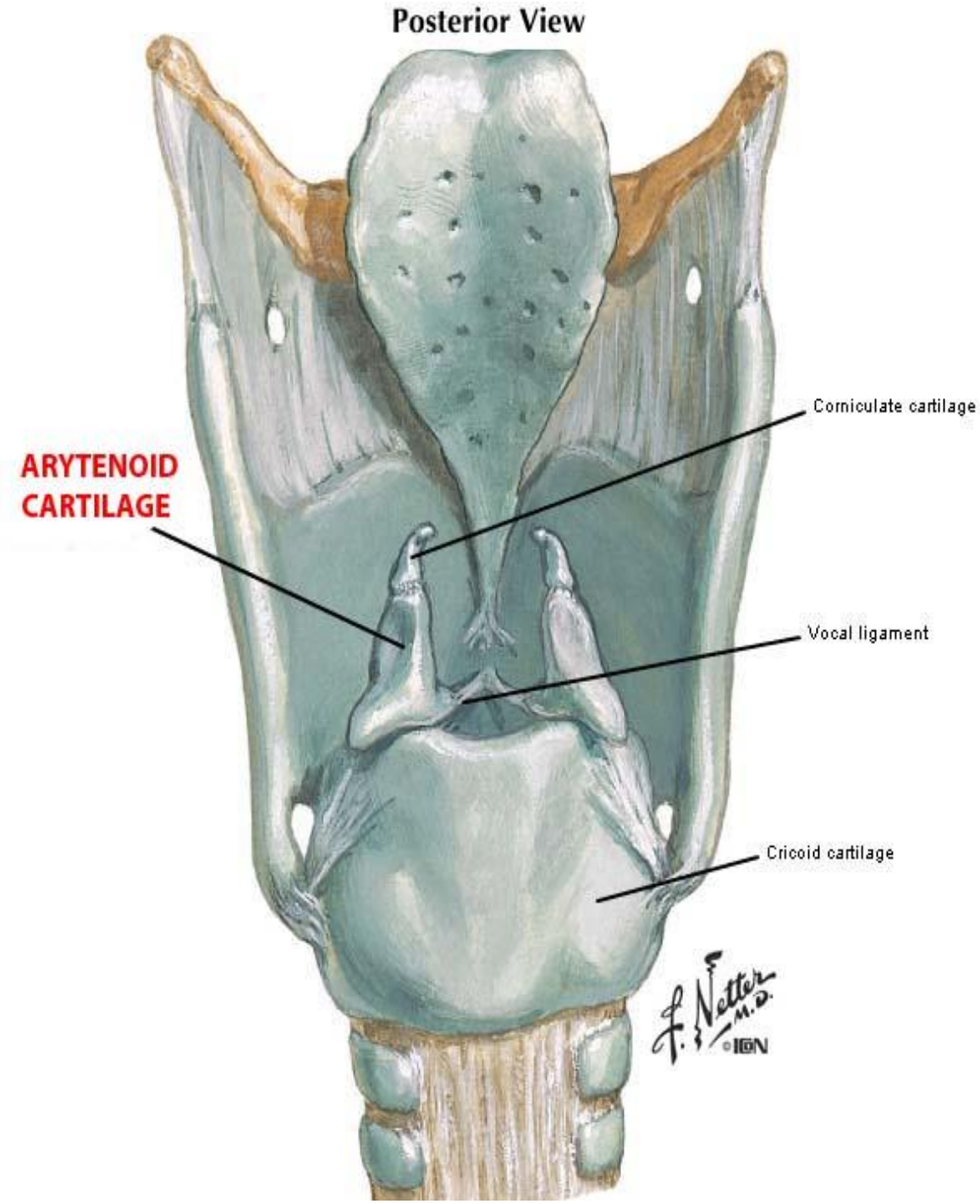

Figure 6 The laryngeal cartilages – posterior view

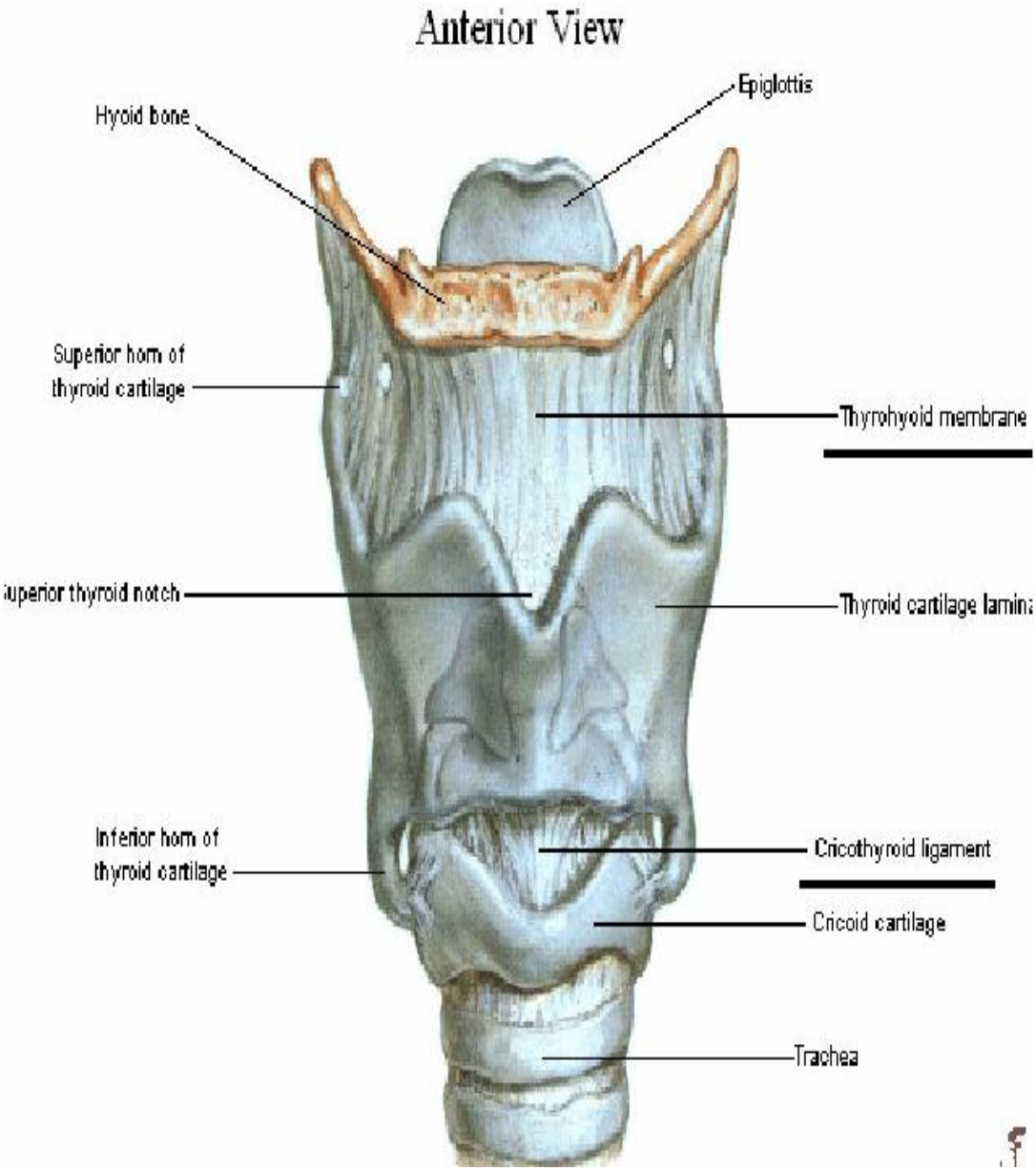

Figure 7 The Laryngeal cartilages – anterior view

- ***The laryngeal ligaments***that attach the laryngeal cartilage can be classified as extrinsic and intrinsic.
    - *The extrinsic ligaments*are :
        - The thyro-hyoid membrane between the thyroid cartilage and the hyoid.
        - The crico-tracheal ligament, that connects the cricoid to the first tracheal ring.
        - The crico-thyroid ligament lies between the thyroid cartilage and the cricoid.
        - The hyo-epiglottic ligament, which connects the epiglottis to the back of the body of the hyoid.
    - *The intrinsic ligaments*are made up of small capsules of synovial joints between the arytenoid and cricoid, and between the thyroid and cricoid cartilages, which is insignificant.

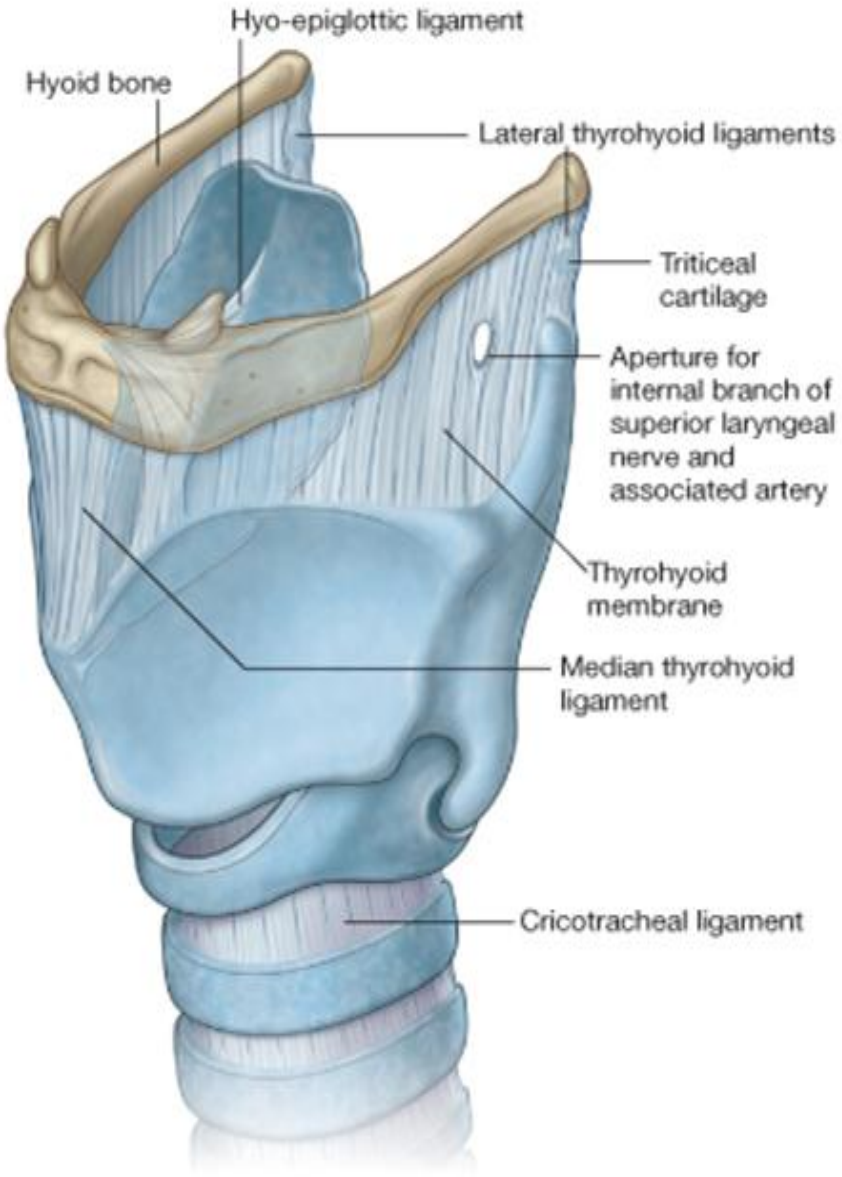

Figure 8 The Laryngeal ligaments

- ***The cavity of the larynx*** is divided into the upper vestibular and the lower vocal fold (or the false and true vocal cords), between which is a slit-like recess termed the sinus of the larynx.

The muscles of the larynx can be divided into the extrinsic muscles, which attach the larynx to its surrounding structures, and the intrinsic muscles, which moves the laryngeal cartilages.

- *The extrinsic muscles of the larynx* are the sterno-thyroid, thyro-hyoid and the inferior constrictor of the pharynx.
    - The sterno-thyroid muscle stretches from the the manubrium to the lateral surface of the thyroid lamina. It is supplied by the ansa hypoglossi and depresses the larynx.
    - The thyro-hyoid muscle passes upwards from the thyroid lamina to the inferior border of the greater horn of the hyoid. It is supplied by fibres of C_1 conveyed through the hypoglossal nerve. It elevates the larynx.
    - The inferior constrictor arises from the thyroid lamina, from a tendinous arch over the cricothyroid muscle and from the side of the pharynx. This muscle acts solely as a constrictor of the pharynx.

Other muscles play an important part in movements of the larynx indirectly. These muscles help to elevate and depress the larynx; they

are the mylo-hyoid, stylo-hyoid, genio-hyoid, sterno-hyoid and omo-hyoid.

- *The intrinsic muscles of the larynx* (a) open the cords in inspiration, (b) close the cords and the laryngeal inlet during deglutition, and (c) alter the tension of the cords during speech. They comprise the posterior and lateral crico-arytenoids, the inter-arytenoids and the ary-epiglottic, the thyro-arytenoid, the thyro-epiglottic, the vocalis and the crico-thyroid muscles.

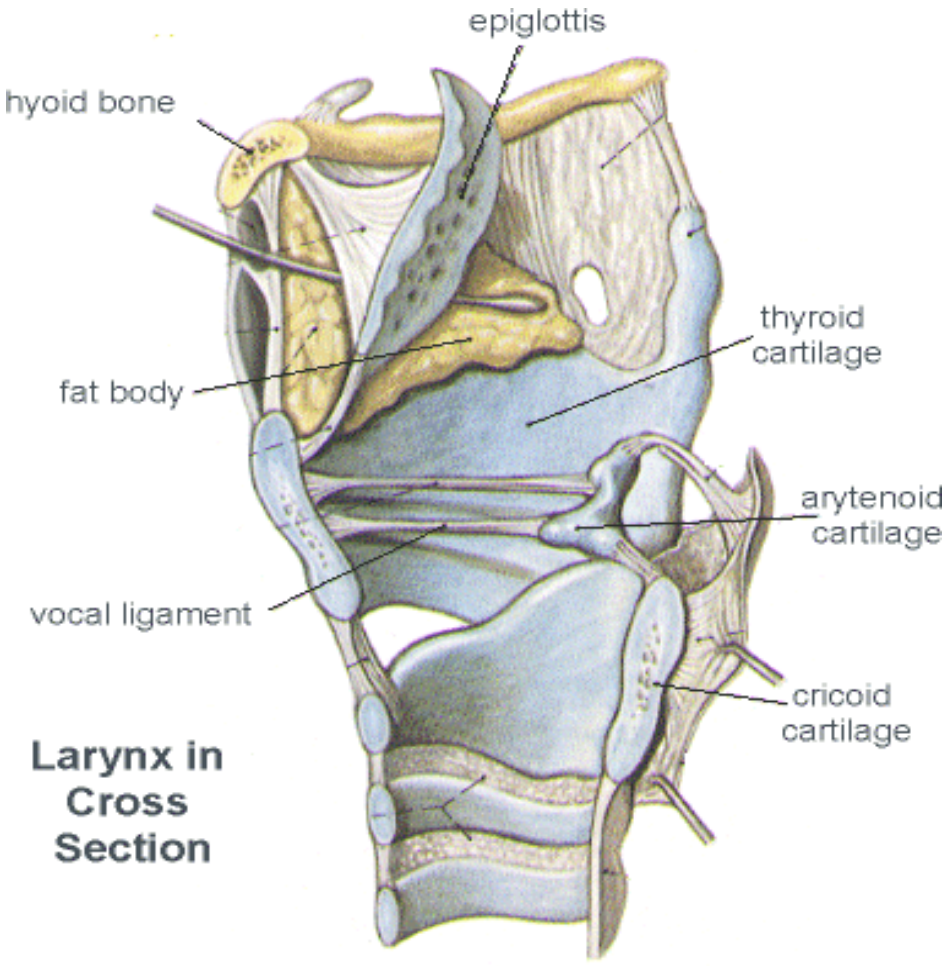

Figure 9 The Cross section of the larynx

AIRWAY ASSESSMENT

The incidence of failed intubation is 1:2000 in all patients who receive general anesthesia.(13) Failed intubation occurs when the laryngeal structures cannot be visualised at laryngoscopy. Airway assessment to identify factors that may cause difficult intubation can prevent this and helps make safe airway management plans. Cormack and Lehane have graded the views of laryngoscopy into four as described in Table 1.(14) Cook studied 500 patients and gave three grades which correlate better with difficult intubation.(15)

Table 1 Laryngoscopy grades

Grade	Laryngoscopic structures
I	Visualization of the entire laryngeal aperture
II	Visualization limited to the posterior portion of the laryngeal aperture, incomplete visualization of the cords
III	Visualization limited to the epiglottis, no visualization of the laryngeal aperture
IV	Visualization limited to the soft palate, no visualization of the epiglottis

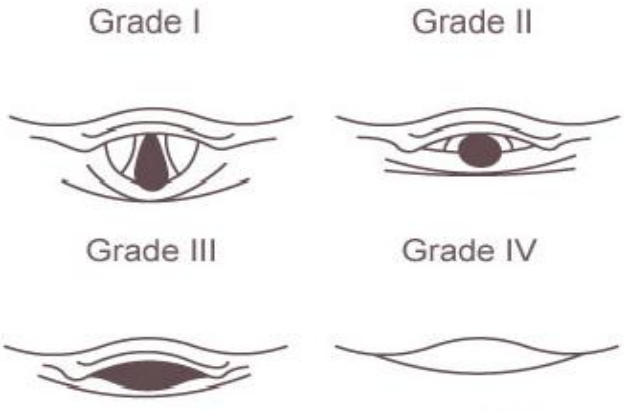

Figure 10 Laryngoscopy Grades

Table 2 Cook's modification of laryngoscopy grades

Quality of laryngoscopy	Criteria of Cook	Cormack and Lehane grade
Easy	Laryngeal inlet visible	I
Restricted	Visibility of posterior glottis structures OR Visibility of epiglottis that can be lifted	II and III
Difficult	No laryngeal apertures visible OR Epiglottis is visible but cannot be lifted	III and IV

The complex anatomy of the airway and it's physiological and pathological variation, alter the laryngoscopic viewsand therefore requires adequate assessment of the airway prior to attempting intubation. Airway assessment begins with a complete clinical history followed by detailed physical examination and augmented by radiological evidence.

History

- ***Medical history*:**
    - Diabetes – Glycosylation of the skin produces scleroderma-like skin which prevents neck extension. Ossification of the posterior longitudinal ligament in the cervical spine impairs movement of the neck..(16)
    - Acromegaly – Thickening of the skin and airway soft tissues which makes mask ventilation difficult. Prognathism and laryngeal stenosis leads to difficult laryngoscopy.(17)
    - Obesity with history of snoring and OSA – Inability to align the axes due to the fat pad on the back compounded by short and thick neck poses difficulty in mask ventilation as well as intubation.
    - Hypothyroidism – Large tongue causes difficulty in mask ventilation. Associated thyroid swellings can distort the airway and cause difficult intubation.
    - Rheumatic conditions – Cervical spine immobility, Temporo-mandibular joint arthritis make airway management difficult in patient with RA and ankylosing spondylitis.
    - Pregnancy – Airway edema may be present. Large breasts interefere with laryngoscopy.
- ***Surgical history***
    - Ludwig's angina and other infections of the throat - The tongue becomes elevated and displaced postero-laterally, which may lead to loss of the airway.

- Tumors on the face – They interfere with mask ventilation
- Tumors of the neckand throat – They compress the airway under anesthesia and cause airway obstruction.
- Trauma – Distortion of the airway anatomy and associated edema causes difficult airway management.

- ***Other factors***
  - Burns – Especially the face and neck burns causing contractures and restricting mouth opening and neck extension cause difficult intubation.
  - Edema – Edema around the airway may pose difficulty in intubation. Edema can occur due to anaphylaxis, due to trauma or in pregnancy.
- ***Past history***
  - Review of old anesthesia records helps makingsafe plans of airway management.

Examination

- ***Observation***
  - Head – A large head poses difficulty in intubation. Physiologically infants have a large head and therefore airway management is anticipated to be difficult.
  - Nostrils – Obstructed nostrils makes mask ventilation difficult. Obstruction can occur due to polyps or tumors or enlarged adenoids.
  - Beard – Inadequate seal causes difficult mask ventilation.
  - Mouth – atleast 2 finger breadths of space between the upper and lower incisors is required for performing satisfactory laryngoscopy. Tumors of

the oral cavity causes difficult mask ventilation as well as laryngoscopy and intubation.

- Teeth – While prominent upper incisors interfere with alignment of the oral and pharyngeal axes during laryngoscopy, edentulous patients may have difficulty in mask ventilation.
- Tongue – A large tongue falls back under anesthesia and obstructs the airway. Determining the large size of the tongue is based on teeth marks on the surface of the tongue and a history of snoring.
- Palate – A high arched palate can cause difficulty.
- Jaw – Tumors of the jaw can interfere with mask ventilation. Retrognathism and prognathism can cause difficulty at intubation.
- Neck – Short and thick neck is associated with difficult airway management. Neck tumors can produce airway obstruction along with distortion of the airway anatomy.
- General condition of the patient – Obesity (BMI > 26) and pregnancy are conditions anticipated to have difficult airway management for various established reasons.

- ***Clinicalexamination – anatomical criteria***
  - Inter-incisor distance: It is the distance between the upper and lower incisors.. The patient is asked to open the mouth maximally and the distance between the upper and the lower incisors is assessed. Normal is > 4.6 cm; while <3.8cm predicts difficult airway.

- Jaw protrusion – Patient is asked to protrude the jaw anteriorly. This can be graded as A, B, and C depending on the extent to which the patient protrudes the jaw. (18) This tests the temporo-mandibular joint mobility.

Table 3. Jaw protrusion grades

Grades	Extent of jaw protrusion
Grade A	Lower incisors can be brought anterior to upper incisors
Grade B	Lower incisors can only be protruded edge to edge with upper incisors
Grade C	Lower incisors cannot be protruded edge to edge with upper incisor

- Mallampati test – The patient is seated opposite to the examiner with the head in neutral position, mouth maximally open and tongue protruded completely without phonation. The visibility of four structures namely the soft palate, the uvula, the faucial pillars and hard palate is assessed. The patients are then classified into any one of the following classes.
  - **Class I :** Visualization of the soft palate, fauces; uvula, anterior and the posterior pillars.
  - **Class II :** Visualization of the soft palate, fauces and uvula.
  - **Class III :** Visualization of soft palate and base of uvula.

  In Samsoon and Young's modification (1987) of the Mallampati classification, a class IV was added.

- **Class IV:** Only hard palate is visible. Soft palate is not visible at all.(19)

Ezri et al added a class 0 which correlates with CL grade of I. (20)

- **Class 0 :** Epiglottis is visible

This test has a sensitivity of 44% - 81% and Specificity of 60% - 80% in identifying patients with difficult airway. Mallampati class I correlates well with a CL grade I and Class IV correlates well with CL grades of III and IV. However the intermediary Mallampati Classes II and III have a range of CL grading from I – IV. Therefore it is not considered a reliable indicator of difficult intubation.

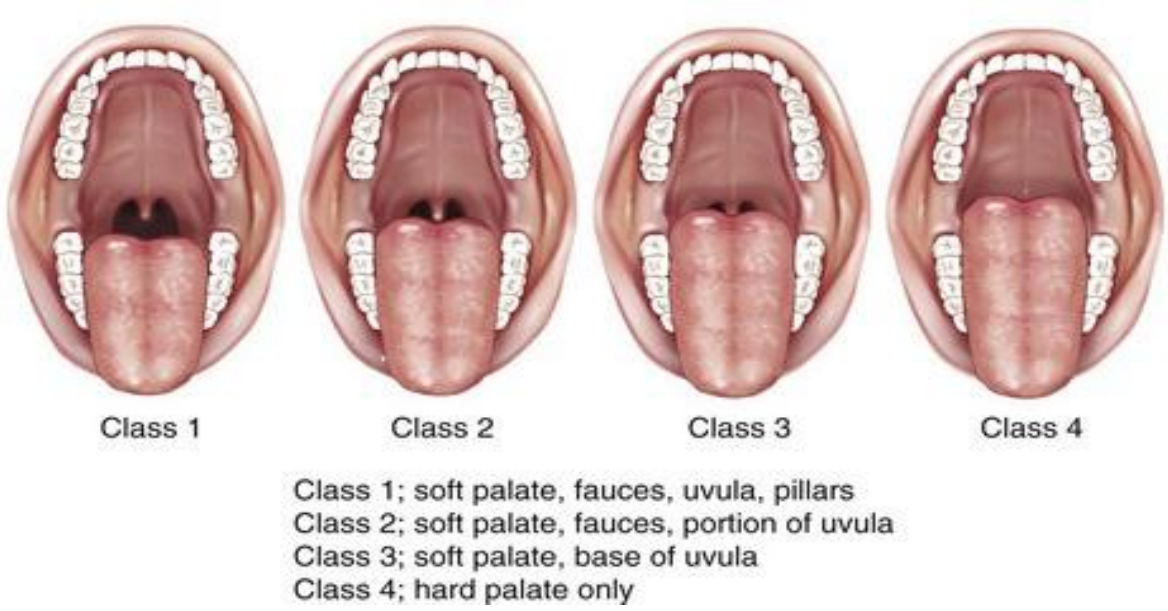

Figure 11. Mallampati Class

- Atlanto-occipital joint (AO) extension: This is assessed to identify difficulties in placing the patient in the Magill's position for intubation. The **Magill's position** for intubation is assumed to align the oral,

pharyngeal and laryngeal axes into a straight line that helps in visualisation of the glottis. The patients head is held in neutral position. The examiner stands by the side and the patient is asked to extend the neck as much as he can. The angle traversed by the occlusal surface of the upper teeth is measured.. Normal angle of extension is more than or equal 35°.(21)

Table 4. Atlantoaxial joint extension

Grades	Angles
Grade I	>35°
Grade II	22°-34°
Grade III	12°-21°
Grade IV	< 12°

- Thyro-mental (T-M) distance (Patil's test): While the patient's neck is in full extension the distance between the chin and the thyroid notch is measured. This helps in determining the ease at which the laryngeal axis and pharyngeal axis will align when the atlanto-occipital joint is extended.> 6.5 cm is normal. Alignment of the two axes becomes difficult if the T-M distance is < 3 finger breadths or < 6 cm in adults; 6-6.5 cm is mildly difficult.
- Sterno-mental distance: The distance between the supra-sternal notch and the mentum while the head is in full extension with the mouth

closed gives the streno-mental distance. A value of less than 12 cm is found to predict a difficult intubation.(22)

- Mandibulo-hyoid distance: The length of the mandible from chin to hyoid should be at least 4 cm or 3 finger breadths. Laryngoscopy becomes difficult as the vertical distance increases.(23)

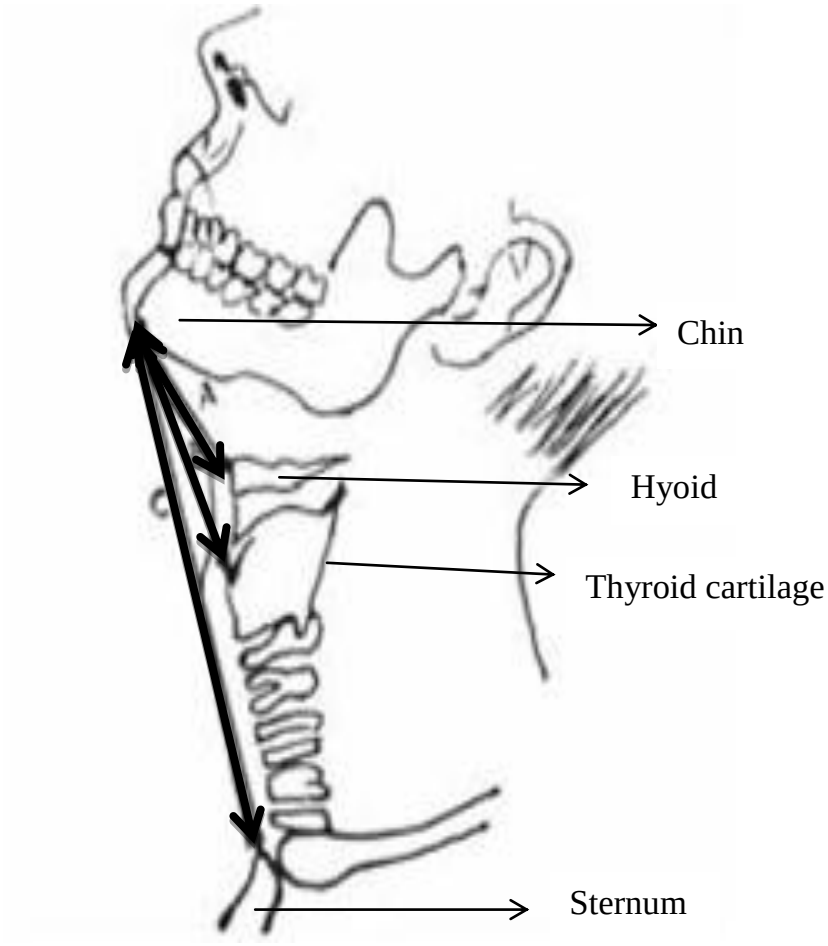

Figure 12. Mandibular space assessment

- Palm print sign: This is used to predict difficult intubation in diabetics. The patients right hand is painted with ink and an impression is made on a paper.Missing interphalageal prints implies joint rigidity caused by

glycosylation. This may also affect the laryngeal and cervical structures. Therefore patients with a positive palm print sign are likely to have difficult intubation. The patterns are categorized as in table 4.(24)

Table 5. Palm print sign

Grades	Patterns seen
0	All phalangeal areas are visible
1	4^{th} and 5^{th} digit interphalangeal areas are deficient
2	2^{nd} to 5^{th} digit interphalangeal areas are deficient
3	Only tips of digits are visible

- Prayer sign: This predicts difficult laryngoscopy in diabetics. The patient is asked to appose both the palms. (24)

  Positive: When there is a gap seen between the palms.

  Negative : When there is no gap seen.

Radiological assessment

The history and clinical examination findings can be augmented by radiological evidence if available.

- ***Skeletal films:*** Lateral cervical x-ray films with the head in neutral position is required to make the following assessments.
    1. Mandibulo-hyoid distance : An increase in this distance results in difficult laryngoscopy. (23)
    2. Atlanto-occipital gap : The space between C_1 and occiput I the A-O gap. If it is < 5 mm, it is indicative of a difficult laryngoscopy.(25)
    3. Mandibular angle and hyoid bone position: When the mandibular angle is more cephalad and hyoid bone is more caudal there is increased incidence of difficult laryngoscopy.(19)
    4. Anterior/Posterior depth of the mandible : An increase in the distance between the bony alveolus immediately behind the 3rd molar tooth and the lower border of the mandible is presumed to hinder displacement of the soft tissues by the laryngoscope blade.(26)
    5. C1-C2 gap:Less than 5mm is suggestive of difficult laryngoscopy.(25)
    6. Calcified stylo-hyoid ligaments are seen as a crease over the hyoid bone on x-ray films. Laryngoscopy is difficult in these cases because of the inability to lift the epiglottis from posterior pharyngeal wall as it is firmly attached to the hyoid bone by the hyo-epiglottic ligament.

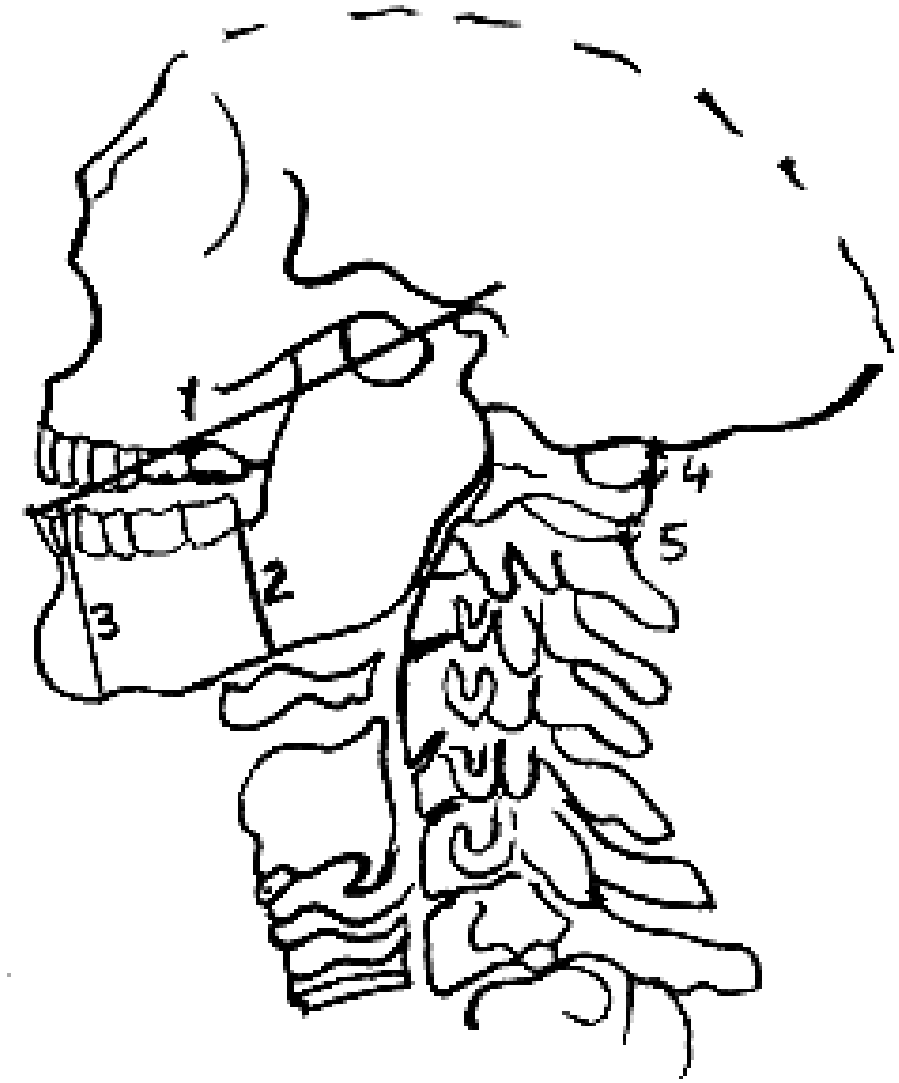

Figure 13 Lateral cervical skeletal film

Note: 1 = Effective mandibular length, 2 = Posterior mandibular depth, 3 = Anterior mandibular depth, 4 = Atlanto-occipital gap, 5 = C1 – C2 gap

- ***Fluoroscopy***: It is done for dynamic imaging (to look at cord mobility,airway malacia, and emphysema).
- ***Oesophagogram:*** Looks at the oesophagus for inflammation, foreign body, extensive mass or vascular ring.
- ***Ultrasonography:*** It is used to look for anterior mediastinal mass, lymphadenopathy and to differentiate cyst from mass and cellulitis from abscess.
- ***Computed tomography/MRI:*** It is useful in congenital anomalies, airway compression due to vascular causes.
- ***Video-optical intubation stylets:*** It combines viewing capability with the familiar handling of intubation devices.(19)

Scoring systems

There is no single factor which identifies difficulty in airway management consistently. This gave rise to the need for scoring systems which includes multiple factors to identify difficult airway. Scoring systems have come a long way from the earliest Wilson score which considers 5 aspects of airway parameters to Benumof's 11 element examination which considers 11 aspects of airway parameters. Even the most complex of the scoring systems have not made it completely possible to identify difficult airway management cases. So these scoring systems should also be used with caution.

- ***Wilson's score***: It was described by Wilson et al in 1988 and it predicts difficult laryngoscopy. It does not predict difficult intubation. A score of 2 predicts difficult laryngoscopy. (27)

Table 6. Wilson score

Criterion	Points		
	0	1	2
Weight (Kg)	<90	90-110	>110
Neck mobility(degrees)	>90	90	<90
Mandibular mobility (refer foot note)	MO > 5cm or Subluxation > 0	MO < 5cm and Subluxation = 0	MO < 5cm and Subluxation < 0
Retrognathia	None	Moderate	Severe
Prominence of upper incisors	None	Moderate	Severe

Note:MO: Mouth opening.

Subluxation:Ability to protrude the lower incisors in front of the upper incisors >0. Ability to protrude lower incisors upto the upper incisors=0. Inability to protrude lower incisors upto upper incisors >0.

- ***El Ganzouri score:*** It is similar toWilson's score but includes thyro-mental distance, Mallampati class and past history of difficult intubation. This scoring system predicts difficult intubation better than Mallampati classification when the score is more than 4. (28)

Table 7. El Ganzouri score

No.	Criteria	Points		
		0	1	2
1.	Weight (kg)	<90	90-110	>110
2.	Head and neck mobility(°)	>90	90+/- 10	<80
3.	Mouth opening(cm)	>/=4	<4	
4.	Subluxation of mandible >0	Possible	Not possible	
5.	Thyromental distance(cm)	>6.5	6-6.5	<6
6.	Malampatti Class	I	II	III
7.	History of difficult intubation	No	Possible	Established

- ***Three criteria of Bellhouse:*** Bellhouse compared the anatomy of patients who had easy intubations with the anatomy of patients with difficult intubation and identified three criteria which together predict difficult intubation. (21)
    - Restricted atlanto-axial joint movement- less than 35degrees
    - Reduced mandibular space- thyromental distance less than 3 finger breadth
    - Enlarged tongue.

- ***Benumof's 11 element examination:*** Benumof grouped 11 elements of airway examination and suggested criteria that must be met in order to identify that intubation will NOT be difficult. It is easy to perform and no apecial equipment is required.

Table 8 Benumof's 11 element examination

No.	11 elements of examination	Criteria in favour of easy intubation
1.	Length of upper incisors	Short – qualitative evaluation
2.	Involuntary anterior overriding of the maxillary teeth on the mandibular teeth	No overriding of the maxillary teeth on the mandibular teeth
3.	Voluntary protrusion of the mandibular teeth anterior to the maxillary teeth	Anterior protrusion of the mandibular teeth relative to the maxillary teeth
4.	Inter-incisor distance(mouth opening)	Over 3 cm
5.	Mallampati class(sitting position)	I or II
6.	Configuration of the palate	Should not appear very narrow or highly arched
7.	Thyromental distance (Mandibular space)	5cm or 3 fingerbreadths
8.	Mandibular space compliance	Qualitative plation of normal resilience
9.	Length of neck	Not a short neck- qualitative
10.	Thickness of neck	Not a thick neck - qualitative
11.	Range of motion of head and neck	Neck flexed 35° on chest and head extended 80° on the neck

- ***Arne score:*** It is a multifactorial index described to predict difficult intubation

Table 9 Arne score

No.	Criteria		Score
1.	Past history of difficult intubation		10
2.	Predisposing pathologies		5
3.	Respiratory symptoms		3
4.	Mandibular mobility		
	Mouth opening > 5cm or subluxation > 0		0
	Mouth opening = 3.5-5cm and subluxation = 0		3
	Mouth opening <3.5cm and subluxation <0		13
5.	Thyromental distance < 6.5cm		4
6.	Head and neck mobility	>100 degress	0
		80-100 degrees	2
		<80 degrees	5
7.	Malampatti class	I	0
		II	2
		III	6
		IV	8
	Total score		48

Note: Predisposing pathologies – facial deformities, acromegaly, rheumatic conditions of the head and neck, diabetes, ENT tumors.Respiratory symptoms – dyspnoea, dysphonia, dysphagia and sleep apnoea.

This was developed in a 2 step process. First, a study was done in 1200 patients in whom 12 different clinical criteria which had statistically significant associations with difficult laryngoscopy and difficult tracheal intubation were recorded. Using a multivariate analysis a multifactorial clinical index to predict difficult intubation was developed. Each criteria was given a point value in proportion to regression coefficients representing the relative weight of each predictive intubation difficulty factor. Second, this index was validated in a prospective study in 1090 patients by 17 senior anesthesiologists. A score more than 11 is predictive of difficult intubation. This has a sensitivity of 93% and specificity of 93%. PPV of 34% and NPV of 99%. (29)

- ***LEMON score:*** It is a simple bedside assessment of certain aspects of the airway in order to identify diffciult laryngodcopy. It was maily proposed for the emergency room intubations. The score with a maximum of 10 points is calculated by assigning 1 point for each . Patients in the difficult intubation group have higher LEMON scores.(30)

L= Look externally (facial trauma, large incisors, beard or moustache, large tongue) – 1 point for each. Total of 4 points.

E= Evaluate the 3-3-2 rule (incisor distance-3 finger breadths, thyroid-mental distance-3 finger breadths, mento-to-hyoid distance-2 finger breadths) 1 point for each. Total of 3 points.

M= Mallampati scoring – 1 point

O= Obstruction (presence of any condition like peritonsillar abscess, trauma,edema,foreign body).- 1 point

N= Neck mobility (limited neck mobility) - 1 point

Figure 14 LEMON Score

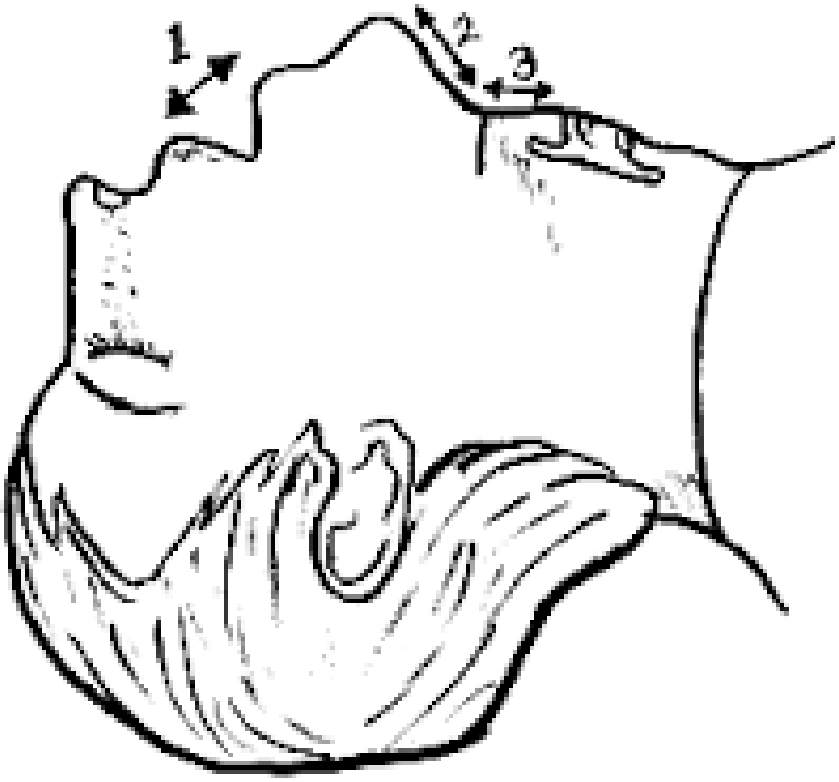

Figure15LEMON airway assessment – This is preferred for the emergency set up with the patient in the supine position.

AIRWAY MANAGEMENT

Routine airway management

- Preparation: Airway management begins with preparation. Equipment needed to maintain airway such as oro-pharyngeal airways, naso-pharyngeal airways, laryngeal mask airways, the direct laryngoscope with a functioning light source, stylets, endotracheal tubes of various relevant sizes, suction apparatus etcetera should be available.
- Pre-oxygenation: The FRC of the lung is filled with oxygen(de-nitrogenation) in order to meet the oxygen needs during the period of apnoea that occurs at intubation. It is defined as 4 vital capacity breaths in 30 seconds or normal tidal volume breaths for 3 min while breathing 100% oxygen. (31)
- Position: The patient is placed in the sniffing position for intubation. The neck is flexed at the cervical spine by placing the head on a pillow of 10 cm thickness. The neck is extended at the atlanto-occipital joint and the mouth is opened. This position aligns the oral, laryngeal and pharyngeal axes into an imaginary straight line.

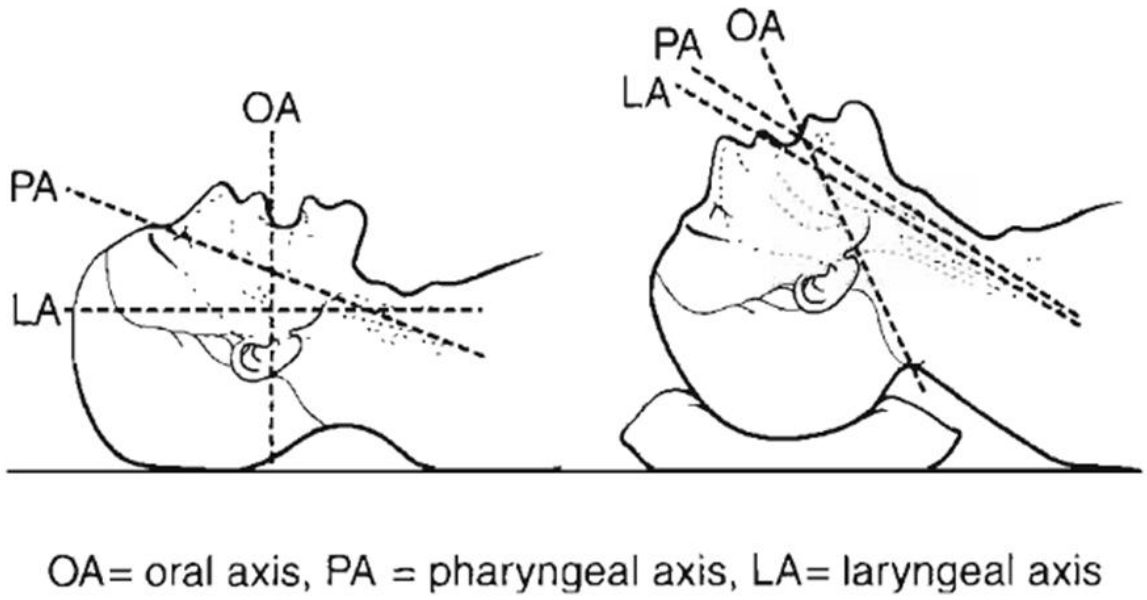

Figure 16 Airway axes

- Pre-treatment: Pre-treatment is done in order to obtund the intubation response and to make the patient unconscious during paralysis and intubation.. Fentanyl, lidocaine etc. are generally used to decreased the sympathetic response. Induction agents have to be chosen based on the existing co-morbid illnesses of the patient. The commonly used agents are thiopentone sodium, propofol, ketamine, sevoflurane or etomidate.
- Paralysis: If the patient's fasting status is adequate, a non-depolarizing muscle relaxant is used. If the patient is "full stomach" either suxamethonium or rocuronium is used. This ensures adequate jaw relaxation needed for tracheal tube placement.
- Placement of tracheal tube: The laryngoscope is held in the left hand. With the patient's mouth opened widely, the blade is introduced into the right side of the

oropharynx, with care to avoid the teeth. The tongue is swept to the left and up into the floor of the pharynx by the blade's flange. The tip of the curved blade is inserted into the vallecula, while the epiglottis is covered by the straight blade. With either blade, the handle is raised up and away from the patient in a plane perpendicular to the patient's mandible to expose the vocal cords. The endotracheal tube is inserted through the vocal cords until the black line is seen at the level of the cords to avoid endo-bronchial intubation(13)

- Proof of placement: The endotracheal tube placement is confirmed clinically by the rise and fall of the chest along with air entry on both sides on auscultation and technically by the etCO_2 trace.
- Post intubation management: Once the placement is confirmed it is secured properly and connected to the ventilator to deliver adequate ventilation, oxygen and anesthetic gases.

Difficult airway management

- Definition: The clinical situation in which a conventionally trained anesthesiologist experiences difficulty with tracheal intubation or both.
- Focus: The primary focus is on the management of difficult airway in the operating room setting.
- Guidelines:
    - Recommendations for the evaluation of the airway:
        - Airway history focussing on factors predisposing to difficult airway management

- Evaluation of the old anesthethesia records
- Airway examination to detect difficult airway
- Additional evaluation in some patients to classify the difficulty

- Recommendations for the basic preparation
  - A difficult airway cart should be available
  - In case of anticipated difficult airway
    - Inform patient
    - Ascertain the availability of an additional individual for help
    - Pre-oxygenation
    - Actively pursue opportunities to deliver oxygen
- Recommendations for the strategy of intubation
  - A strategy should be formulated based on the surgery, the condition of the patient and the skills and preferences of the anesthesiologist.
  - Algorithm:

DIFFICULT AIRWAY ALGORITHM

1. **Assess the likelihood and clinical impact of basic management problems:**
   - **Difficulty with patient cooperation or consent**
   - **Difficult mask ventilation**
   - **Difficult supraglottic airway placement**
   - **Difficult laryngoscopy**
   - **Difficult intubation**
   - **Difficult surgical airway access**
2. **Actively pursue opportunities to deliver supplemental oxygen throughout the process of difficult airway management.**
3. **Consider the relative merits and feasibility of basic management choices:**
   - **Awake intubation *vs.* intubation after induction of general anesthesia**
   - **Non-invasive technique *vs.* invasive techniques for the initial approach to intubation**
   - **Video-assisted laryngoscopy as an initial approach to intubation**
   - **Preservation *vs.* ablation of spontaneous ventilation**
4. **Develop primary and alternative strategies:**

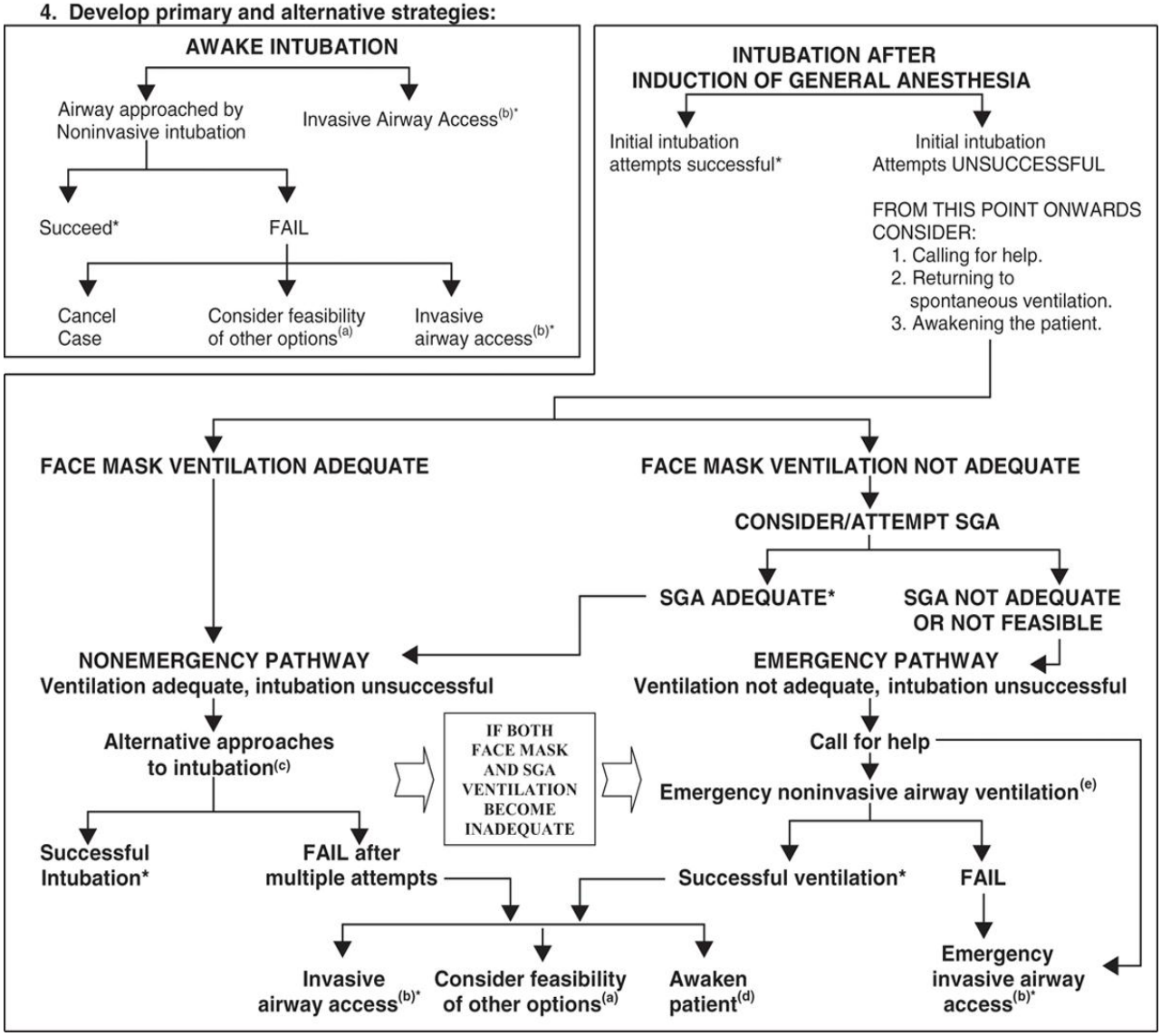

Figure 17. Difficult airway algorithm(ASA guidelines)

- Recommendations for the strategy of extubation
    - A strategy for extubation is also made along with the intubation strategy.
    - The plan should consider the advantages of awake extubation versus deep extubation and the factors which can interfere with ventilation, post extubation. It also considers an airway management plan in case oxygenation is not maintained post extubation.(31)

GLIDESCOPE

The Glidescope Video-Laryngocope (GVL), is a fourth generation video-laryngoscope consisting of a non-glare color monitor, reusable GVL blades of different sizes, and a GlideRite rigid stylet. (32) This was invented by Dr. John Pacey. Study of the MRI images of the lateral view of the neck, identified that a 60° angulation and a camera placed atleast 6 cm away from the larynx is required to get the best visualisation of the larynx. (33) Scope with an acute angle along with a antifogging camera accompanied by LED light sources that produce a well illuminated panoramic view of the glottis out of line of sight was then developed.

Equipment description

- Monitor – Color monitor, 6.4inches(Diagnonal), 440 X 234 mm, Height- 167mm, Width- 207mm, Depth -83mm, Weight- 1.4kg
- Video baton – It has a single video baton that fits all the different sizes of blade.

- Camera – It has an antifogging camera that produces high definition images using a CMOS(Complementary Metal Oxide Semiconductor) technology camera. The camerais only 3 cm away from the tip of the blade.(34)
- Blades – The GVL blade is different from the regular macintosh blade, in that it has a 60° angle at the middle of the blade providing a view axis of 290° which is much greater than the 90° view axis of macintosh.(1) Different sizes are available from ranging from 2-5. Based on the weight of the patient, the size is chosen. GVL 3 and 4 were used in this study and therefore described in detail.
    - GVL 3 – Blade length: 82mm, Thickness at camera: 14.5 mm, Width at camera: 20 mm. This is used in patients weighing 10kg-adult
    - GVL 4 – Blade length: 102mm, Thickness at camera: 14 mm, width at camera: 27mm. This is used in patients weighing 40kg to morbidly obese.
- Stylet – The rigid stylet with the preformed curvature that complements the GVL blade curvature is called the GlideRite. It is hockey-stick like and facilitates intubation using GVL.(32)

Techniqueof insertion

The GVL does not align the oral, pharyngeal and laryngeal axes. The image that it captures is out of line of sight and therefore has specific recommendations for insertion to avoid trauma and achieve successful intubation. The following are the recommendations from the user's manual of the GVL.

- The scope is inserted in the midline of the oral cavity towards the epiglottis.
- Once the epiglottis is visualised the Miller's lift or the epiglottis lift is used to visualise the cords.
- The GlideRite rigid stylet must be used. If not, a malleable stylet with a 60-90° angulation should be used.
- The four step technique is followed to avoid trauma to the oral cavity.

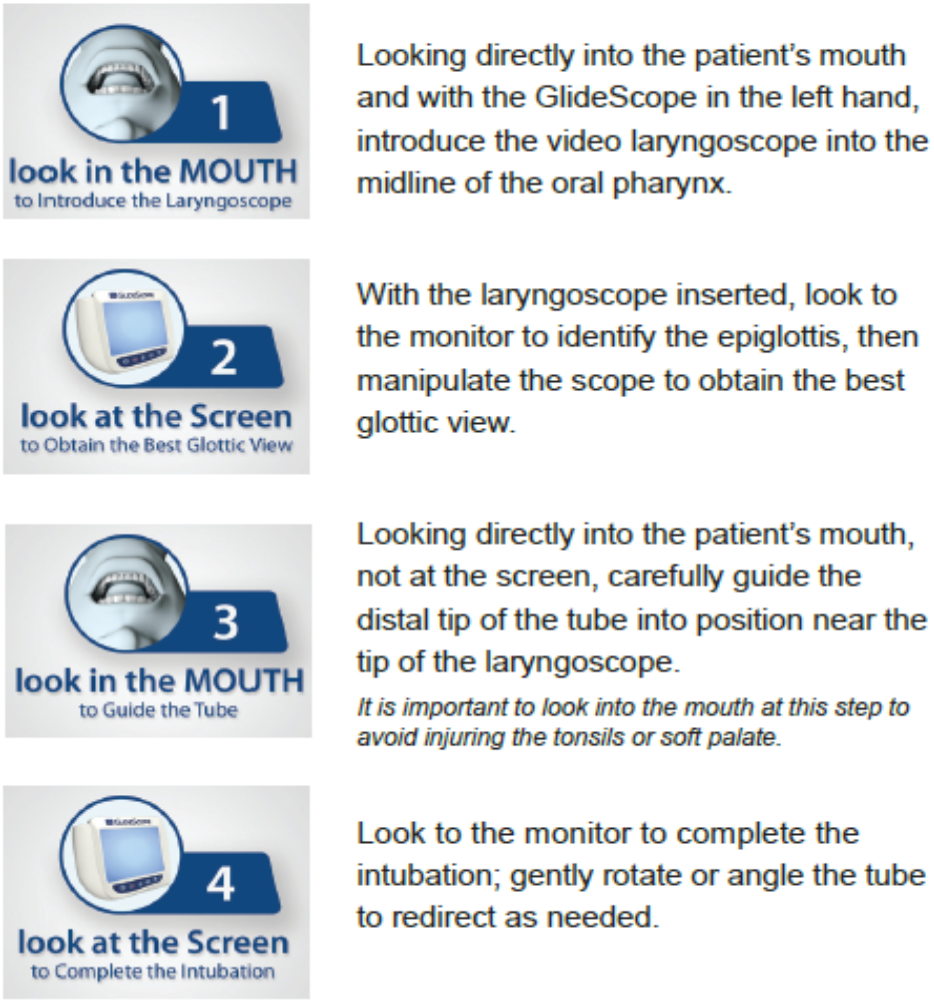

Figure 18 The four step technique for glidescope use

Indications

- It is used for teaching purposes
- It is used in patients with anticipated and unanticipated difficult airway management
    - Mallampati class III/IV
    - Neck movement – Moderate/Severe limitation/Patients on cervical collar**.**
    - Other causes:
        - Infections:Abscess (intraoral-Distortion of the airway and trismus,retropharygeal), Ludwig's angina -Distortion of the airway and trismus
        - Arthritis:Rheumatoid arthritis (deviation of laynrx, restricted mobility of cervical spine), Ankylosing spondylitis(Ankylosis of cervical spine, lack of mobility of cervical spine)
        - Tumors of the neck :Benign- Cystic hygroma, lipoma, adenoma, goiter (Stenosis or distortion of the airway),Malignant tumors of the oral cavity/ neck - Stenosis or distortion of the airway, fixation of larynx or adjacent tissues secondary to infiltration or fibrosis from irradiation of the neck
        - Trauma: Facial injury, cervical spine injury, laryngeal/tracheal trauma - Edema of the airway, hematoma
        - Obesity -Short thick neck, redundant tissue in the oropharynx, sleep apnea

- Acromegaly- Macroglossia, prognathism
- Burns with neck contractures

Contraindications

- It is contraindicated in patients with limited mouth opening, since it cannot be inserted if the mouth opening is restricted.

Advantages

- It is estimated to have reduced lifting force of 0.5-1.5kg compared to normal laryngoscopy.(35) Thereby minimising the sympathetic responses to intubation. This proves beneficial in patients with cardiac illness and raised ICP.
- The ability to visualise the larynx without movement of the head has been useful in patients with cervical spine disease. (36)

Disadvantages

- The image acquired by the GVL is out of line of sight and therefore requires mandatory use of the stylet . This makes the airway more prone for trauma.
- There is an apparent blind spot in the GVL. The camera does not focus on the tangent of the blade beyond the camera. This again may produce trauma.(37)

Complications

The difficulties and complications reported so far with GVL are inability to visualise, inability to intubate, tonsillar pillar perforation, arytenoid displacement, soft palate perforation (9)(6)(8)(7)

RESEARCH QUESTIONS

Is there an increased incidence of trauma with GVL?

There are atleast 6 case reports in one single year 2007-2008. This is significant and needs addressing. Out of these one was right soft palate perforation, one was right anterior tonsillar pillar perforation, and four were right palate-pharyngeal arch injury. (34)

Why is there an increase in incidence of trauma?

A review of the literature reveals many reasons for airway injury with the use of GVL. As mentioned earlier,

- The image of the larynx is visualised out of plane. (1)
- There is a blind spot in the visualisation of the camera. It does not visualise the tangent of the scope beyond the camera. (37)
- The use of the rigid stylet is mandatory.(32)

Are there recommendations to overcome difficulties encountered?

The above listed reasons are possible reasons for airway trauma. However there are recommendations for the conduct of laryngoscopy with GVL that can avoid trauma as discussed in the glidescope section.

If so, why is there an increasing incidence- research hypothesis?

It was hypothesised in this study, that the increased incidence is due to lack of knowledge of the technique of insertion.

NULL HYPOTHESIS

Good knowledge of the use of technique of insertion decreases the incidence of complications.

How can the null hypothesis be disproved?

Theincidence of complications with the use of GVL by experienced anesthesiologist (defined as anyone more than 3 years of experiencein anesthesiology) is estimated. If significant, it disproves the null hypothesis.

METHODS

The IRB(Instituitional Review Board) approval was obtained before initiation of the study. The sample size was calculated based on the hospital statistics of trauma with glidescope which was approximately 5%.

Sample size calculation

Hypothesis Testing for Single Proportion

Population Proportion = .02

Sample Proportion = .05

Power (%) = 80

Alpha Error (%) = 5

Sided = 2

Required sample size = 233

Alpha Error(%)	Power(%)	Sample Size(n)
	70	251
1	80	330
	90	456
	70	168
5	80	233
	90	341

	70	131
10	80	190
	90	288

Note: with reference to the hospital statistics regarding the trauma due to glide scope intubation was found to be 2%(Population Proportion) with an assumed sample proportion to be at 5% with a power at 80% and an alpha error at 5% we need to study at least 233 patient under going GS Intubation.

Formula

$$H_o : P = P_o \; ; \qquad H_a : P \neq P_o$$

$$n = \frac{\left\{Z_{1-\alpha/2}\sqrt{P_o(1-P_o)} + Z_{1-\beta}\sqrt{P_a(1-P_a)}\right\}^2}{(P_a - P_o)^2}$$

Where,

P_0 : Population proportion

P_a : Sample proportion

α : Significance level

$1-\beta$: Power

Inclusion criteria

Patients were recruited based on the PAC (Pre-Anesthetic Clinic) records which mentions the airway indices.

- Patients over 18 years of age
- Patients anticipated to have difficult airway management will be identified based on clinical examination in PAC.
    - Mallampati class III/IV
    - Neck movement – Moderate/Severe limitation/Patients on cervical collar.
    - OTHER CAUSES
        - Infections:
        - Intraoral abscess(Distortion of the airway and trismus,retropharygeal)
            - Ludwig's angina -Distortion of the airway and trismus
        - Arthritis:
            - Rheumatoid arthritis: deviation of laynrx, restricted mobility of cervical spine
            - Ankylosing spondylitis- Ankylosis of cervical spine, lack of mobility of cervical spine
        - Tumors of the neck :
            - Benign :Cystic hygroma, lipoma, adenoma, goiter - Stenosis or distortion of the airway,
            - Malignant tumors of the oral cavity/ neck - Stenosis or distortion of the airway, fixation of larynx or adjacent tissues secondary to infiltration or fibrosis from irradiation of the neck
        - Trauma: Facial injury, cervical spine injury, laryngeal/tracheal trauma - Edema of the airway, hematoma
        - Obesity -Short thick neck, redundant tissue in the oropharynx, sleep apnea

- Acromegaly- Macroglossia, prognathism
- Burns with neck contractures

Exclusion criteria

- Patients with mouth opening less than 2 finger breadths
- Use of GVL for unanticipated difficult airway

Informed consent

Informed consent was obtained after allowing the patients to read the information sheet in their respective languages and after clarifying their doubts.

Thesis protocol

1. Glidescope intubation was performed by any anesthesiologist with more than three years of experience.(ISA definition of an experienced anesthesiologist)
2. It was performed in the following manner:
    a. A timer was turned on to estimate the time to visualise and time to intubate.
    b. The GlideScope® was first introduced into the midline of the oral pharynx with the left hand.
    c. The epiglottis was identified on the screen and the scope was manipulated to obtain the best glottis view.
    d. The endotracheal tube was then guided into position near the tip of the laryngoscope by direct vision.

e. When the distal tip of the endotracheal tube disappears from direct view, it was viewed on the monitor. The tube was gently rotated and redirected to pass through the cords.

f. Once the tube had been inserted into the trachea, the circuit was connected to the tube and ventilation initiated to get an etCO2 trace, WITH THE SCOPE INSITU.

g. The time to visualise and the time to intubate was noted down in seconds. (Definitions: Time to visualise is the time taken from the time of insertion of scope to time of visualisation of the cords. The time to intubate is the time of visualisation to time of satisfactory etCO2 trace.)

h. The scope is then withdrawn while looking for evidence of trauma.

3. The rigid stylet was used. In case of difficulty in intubation with that, malleable stylet could be used and it had to be noted down.
4. The proforma was then filled up and the Intubation Difficulty Scale (IDS) was calculated. (Enclosed in annexures) The IDS has seven variables. Each variables has different values. A score of 0=easy intubation. A score of 1-5 was slightly difficult intubation. And a score > 5 is moderate to major difficulty. An infinite score implied impossible intubation. (38)

IDS

N1=No. of intubation attempts >1

N2=No. of operators >1

N3=No. of alternative intubation techniques used

N4=Glottic exposure (Cormack and Lehane grade minus 1)

N5=Lifting force required during laryngoscope (0 - normal, 1 - increased)

N6=Necessity for external laryngeal pressure (0 - not applied, 1 - applied)

N7=Position of the vocal cords at intubation (0 - abduction/ not visualized, 1 - adduction)

IDS score	Degree of difficulty
0	Easy
0 < IDS ≤ 5	Slight difficulty
5 < IDS	Moderate to major difficulty
IDS=¥	Impossible intubation

Figure 19. Intubation difficulty scale

Data entry

The collected data was entered on epidata and exported to excel for further analysis. For objective assessment of the airway and to quantify the level of anticipated airway difficulty, 7 element Arne score was calculated from the available data on airway assessment and entered as a numeral.It has threshold value of 11 in identifying difficult airway with more than 90% specificity and sensitivity.(Table 9)This was correlated with Intubation Difficulty Scale.

Data analysis

- Descriptive statistics was reported using mean +/- SD (median, IQR) Categorical variables was reported using frequency and percentage.
- Chi Square was used to check the association between outcome and the other variables.
- Risk factor analysis for the outcome was done using generalized linear models(GLM) using stepwise method.

RESULTS AND ANALYSIS

The number of cases recruited for the study was 150. However the number of cases which were intubated with glidescope was only 90 due to the availability of just one GVL. In addition, one patient was intubated by a junior anesthesiologist with 6 months experience and hence excluded. The final number of cases in this study was 89.

Demographic data of study population

The mean age of the patients who took part in the study was 51 ±13 years, the minimum being 18 years and the maximum being 82 years. 60/89 were males (67.4 %)and 29/89 were females (32.6%).The average height was 160 ±9 cms, the average weight was 70±13 kgs and the average BMI was 27±5. The numbers of patients with ASA status I were 35(39.3%), ASA status II were 48(53.9%) and ASA status III were 6(6.7%).

Table 10 Demographic data of the study population

Sno.	Variables	Number	Values
1.	Mean age of study population(years)	89	51±13(18-82)
2.	Male participants	60	67.4%
	Female participants	29	32.6%
3.	ASA status I	35	39.3%
	ASA status II	48	53.9%
	ASA status III	6	6.7%
4.	Mean Height (cms)	89	160 ± 9 (141-178)
5.	Mean Weight (kgs)	89	70 ±13 (39-101)
6.	Mean Body Mass Index(BMI)	89	27±5(15-43)
7.	Surgical diagnosis:		
	Renal	6	7%
	Ortho	5	6%
	Spine	22	25%
	Neuro	13	14%
	Neck	9	10%
	Head	5	6%
	GI	17	19%
	ENT	3	3%
	Heart	6	7%
	Lung	1	1%
	Breast	1	1%

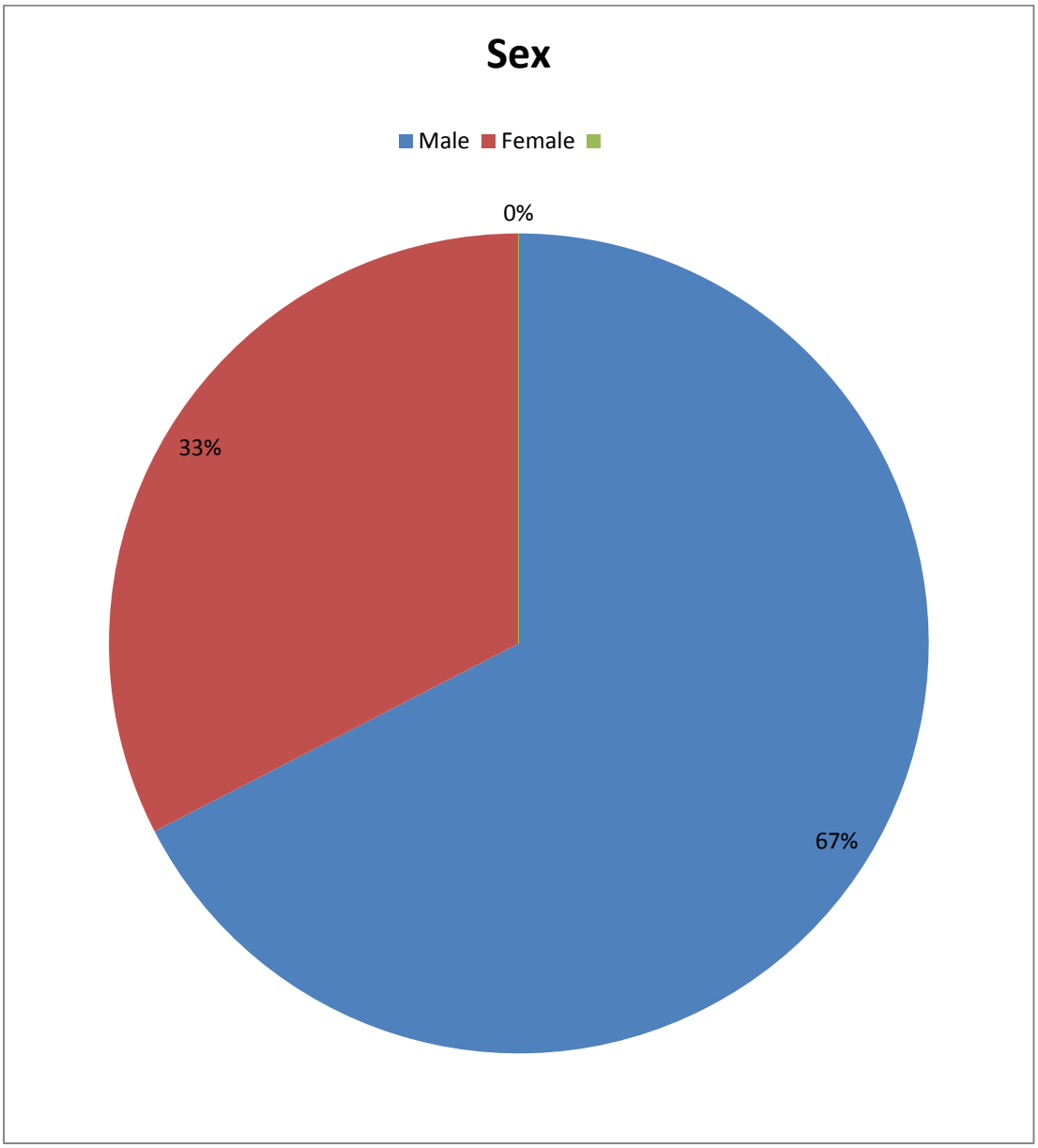

Figure 20. Sex distribution of the participants in the study.

Most of the patients were males.

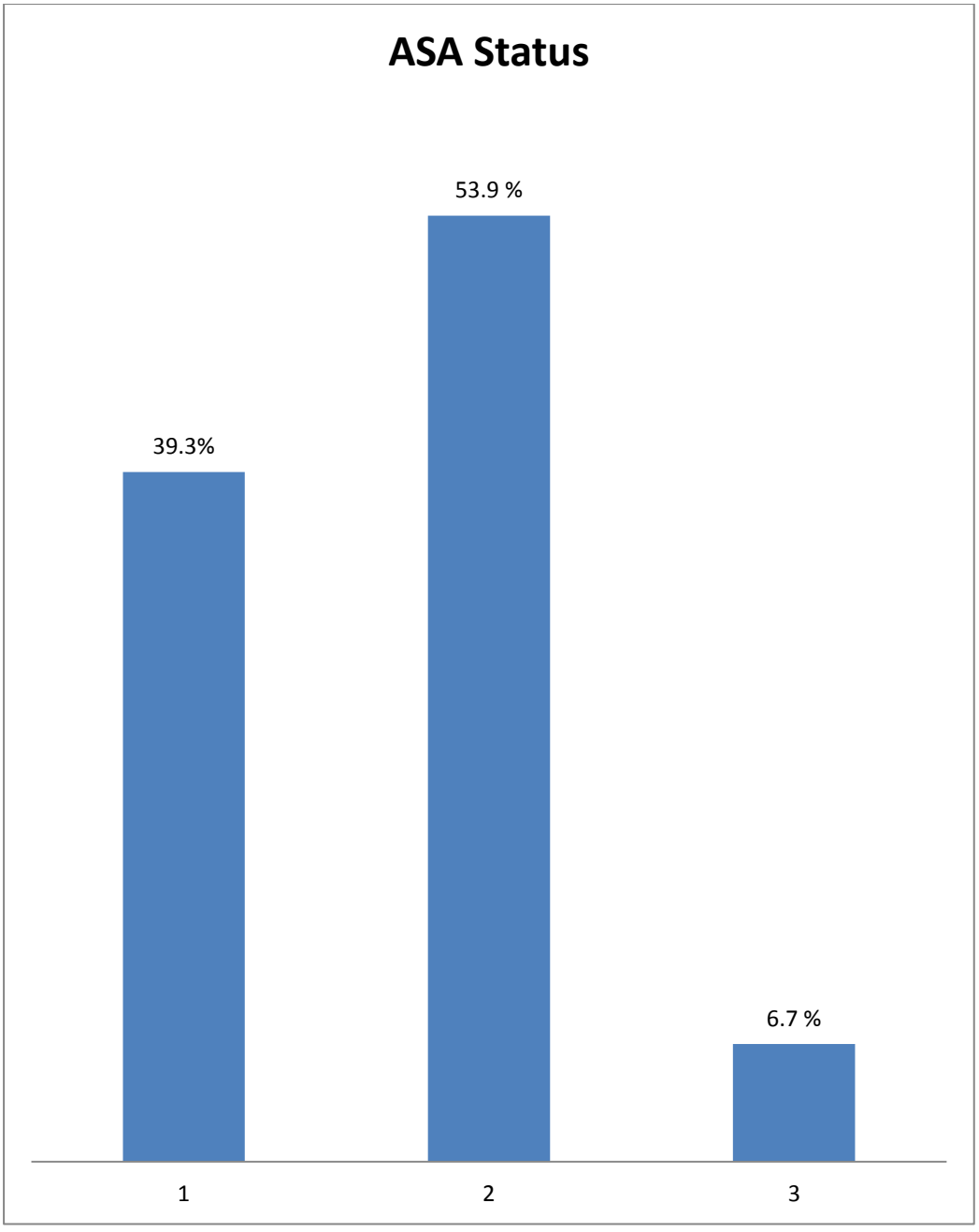

Figure 21 ASA status of the study population.

Majority of the patients were ASA II.

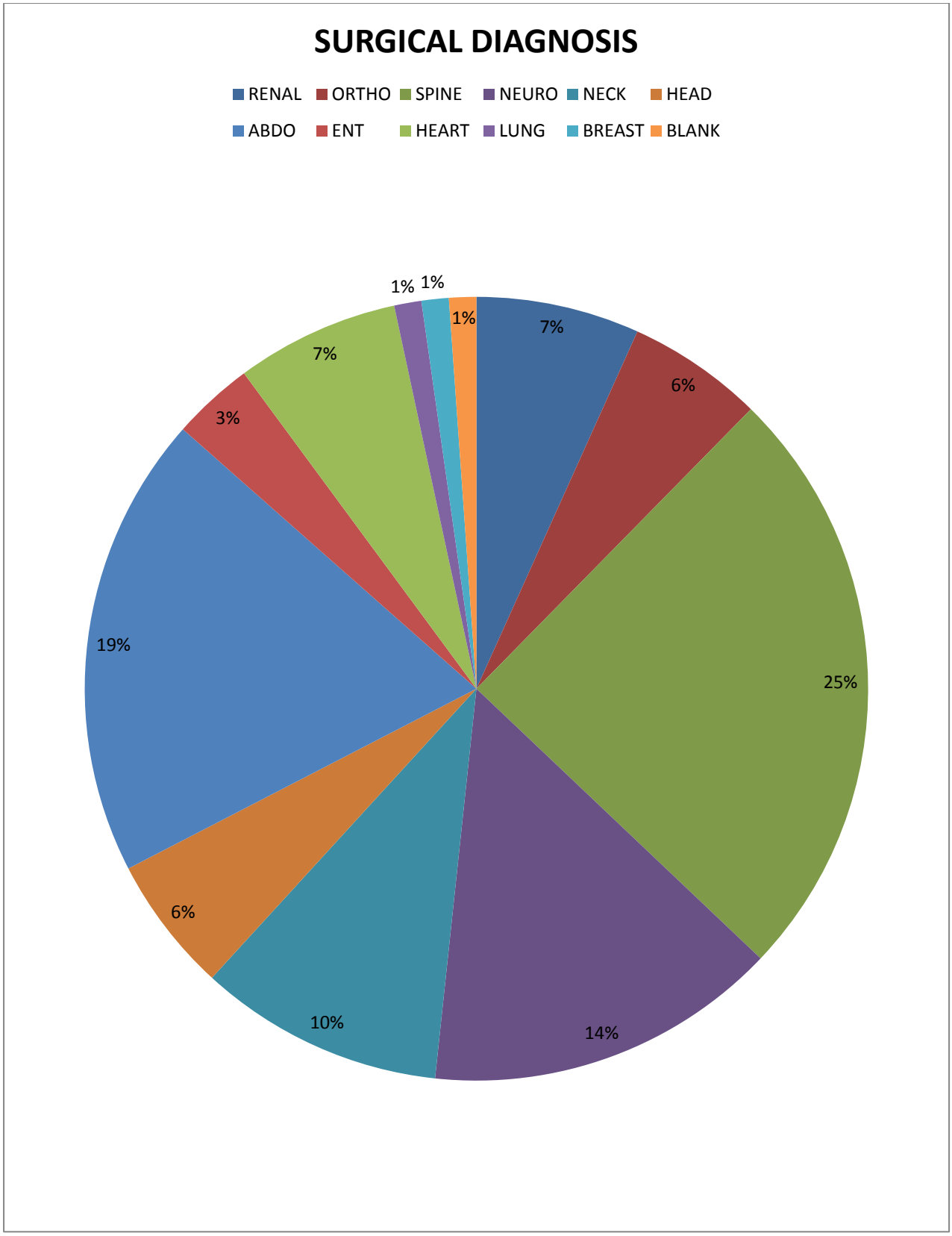

Figure 22.Surgical diagnosis of the study population.

Most patients had spine surgery, followed by abdominal surgery and neurosurgery.

Arne score

Although the inclusion criterion was difficult airway as assessed by the anesthesiologist, Arne score which objectively defines predicted difficult airway was also assessed. It predicts difficult intubation with a threshold value of 11 with over 90% sensitivity and specificity. The patient population with an Arne score of < 11 were 33/89(37%) and the patient population with the Arne score ≥11 were 56/89 (63%). Most of the patients had Arne score of ≥11which reflects on the good clinical skills of the intubating anesthesiologist in airway assessment.

Table 11. Arne score

Arne score	Numbers	Percentage
<11	33	37% (predicted easy intubation)
≥11	56	63% (predicted difficult intubation)

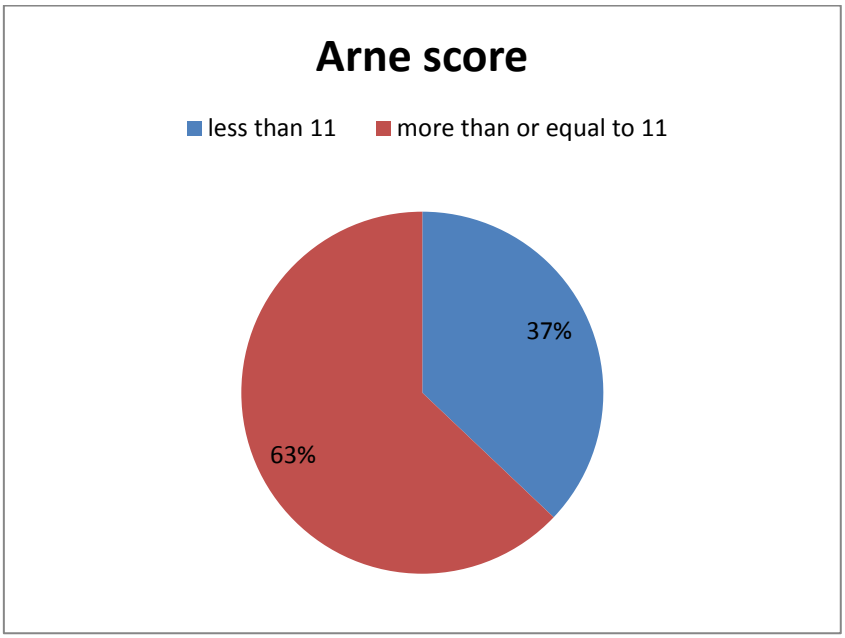

Figure 23. Arne score.

Level of experience of the intubating anesthesiologist

The years of experience of the intubating anesthesiologists were 6±3 years on an average. (n=73). 60% of the intubating anesthesiologists had a prior exposure to atleast 20 GVL intubations.

Table 12. Level of experiencein anesthesiology and GVL intubations

Variable		Values n=86
Years of experience		6±3 years (3-14)
GVL familiarity	<20	37(42%)
	>20	49(55%)

Intubation difficulty scale

IDS cannot be 0 in this study. The use of GVL adds 1point and the definitive use of stylet adds another point. So for all cases the baseline IDS was 2.Therefore the patients who had IDS >2 were considered to be difficult intubation in this study. The patients who had IDS ≤ 2 were10/89 (11%) and the patients with IDS > 2 were 79/89(89%).

Table 13 IDS. The varying degrees of difficult intubation and their incidence in this study is tabulated below.

IDS	Numbers	Percentage
≤2(easy)	10	11%
3-5(mild difficulty)	66	74%
>5(moderate difficulty)	13	15%

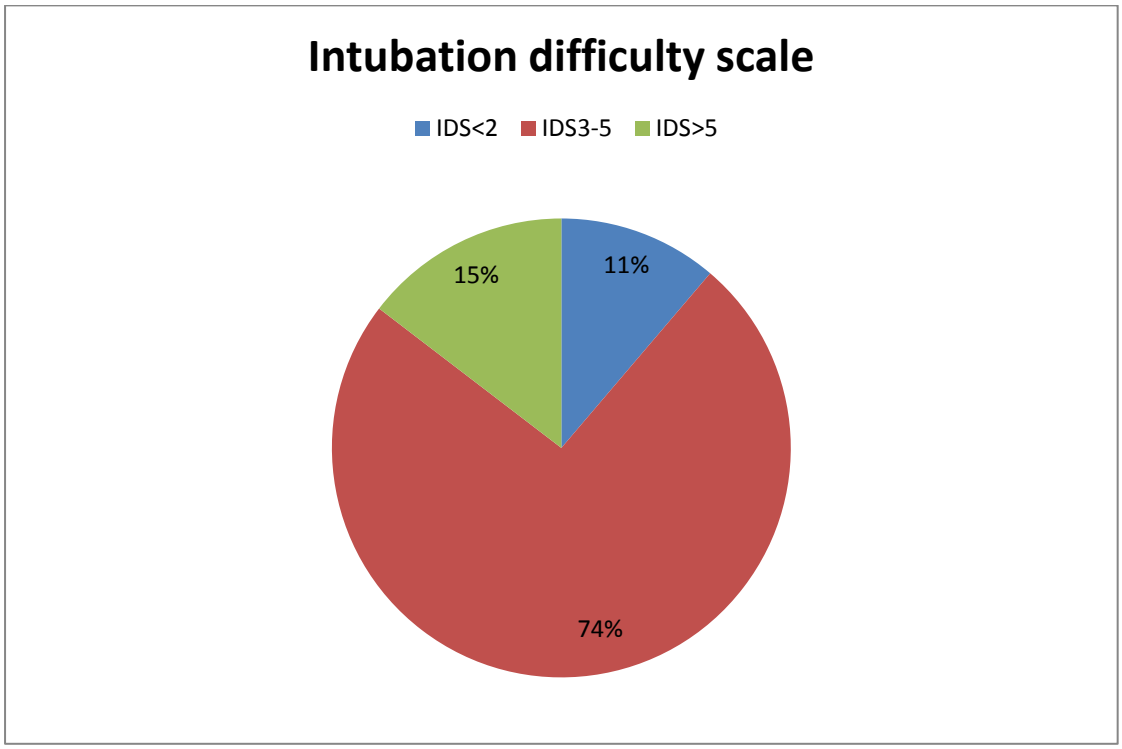

Figure 24. Intubation difficulty score.

The baseline IDS for this study was 2 considering 1 point for glidescope use and one point for stylet use(use of stylet is mandatory with glidescope).

Time to visualise and time to intubate

The average time to visualise was 19 ± 17 seconds and the average time to intubate was 46± 26 seconds. The standard deviation is more than half of the mean which means there is wide range of timings. This raises the doubt of misunderstanding of the definitions of the time to visualise and time to intubate, by the intubating anesthesiologist.

Table 14. Time to visualise and intubate

Variable	Duration (seconds)
Time to visualise	19±17 (3-90)
Time to intubate	46±26 (7-150)

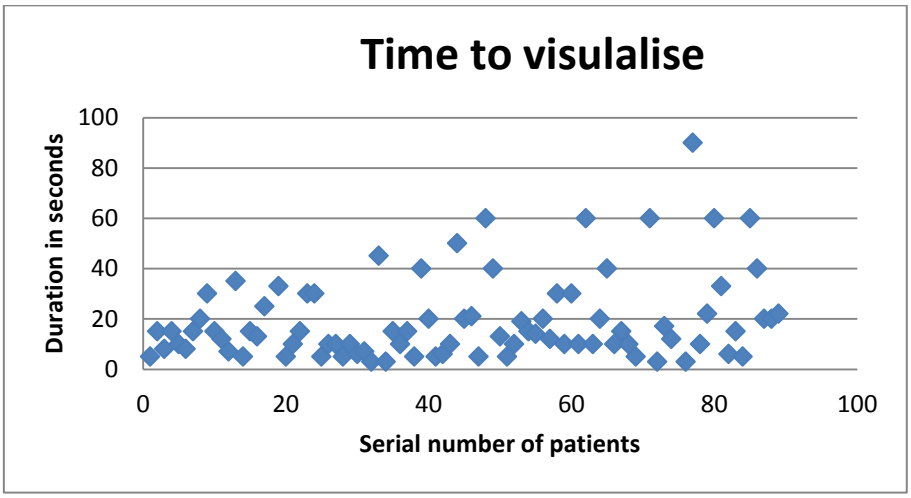

Figure 25. Scatter plot of the time to visualise

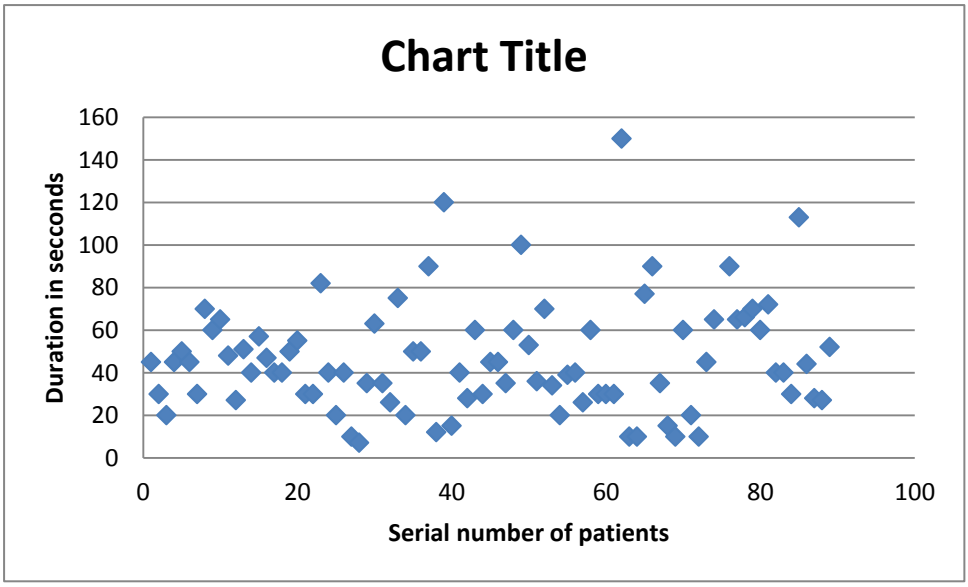

Figure 26. Scatter plot of the time to intubate

Airway trauma

The incidence of trauma was 11.2% in this study (10 out of 89 cases). The average age of the patients in this group was 53±15 years. The numbers of males were 5/10 (50%) and the numbers of females were 5/10 (50%). There were 4 patients with ASA status 1(40%), 4 patients who were ASA 2(40%) and 2 patients who were ASA 3 (20%). The mean height was 157±6 cms. The mean weight was 68±13 kgs. The average BMI was 27±5. The patients with Arne score <11 were 40%(4/10) and the patients with Arne score ≥11 was 60%(6/10). The mean of the years of experience of the intubating anesthesiologist was 5±2 years. 6/10(60%) of the anesthesiologist had more than 20 attempts at GVL intubation,4/10(40%) had <20 attempts at GVL intubations. The time to visualise was 24±21 seconds and the time to intubate was 50±28 seconds. The sites that were injured included lips(5/10), faucial pillars(1/10), vallecula(1/10), larynx(2/10) and teeth(1/10). All were minor trauma.***None of them required surgical treatment.*** The difficulty encountered most frequently was difficulty in directing the tube towards the cords. There was no desaturation in any patients who had trauma.

Table 15. Characteristics of patients with airway trauma with the use of GVL

Sn	Variable	Trauma	
		No.	Values
1.	Mean age(years)	10	53±15(31-82)
2.	Males	5	50%
	Females	5	50%
3.	ASA 1	4	40%
	ASA 2	4	40%
	ASA 3	2	20%
4.	Mean height (cms)	10	157±6(145-165)
5.	Mean weight (kgs)	10	68±13(44-83)
6.	Mean BMI	10	27±5(21-35)
7.	Arne score <11	4	40%
	Arne score ≥11	6	60%
8.	Years of experience	10	5±2 (3-10)
9.	GVL familiarity <20	4	40%
	GVL familiarity >20	6	60%
10	IDS≤5	9	90%
	IDS>5	1	10%
11	Time to visualise	10	24±24(5-60)
12	Time to intubate	10	50±30(10-113)
13	Technical difficulties with GVL	9	90%

Table 16. Sites of trauma.

Lip injury was the commonest injury. The difficulties encountered at intubation in the patients with lip injury were difficulty in directing tube towards the cords and less working space.

Site of injury	Numbers
Lips	5
Faucial pillars	1
Vallecula	1
Larynx	2
Teeth	1

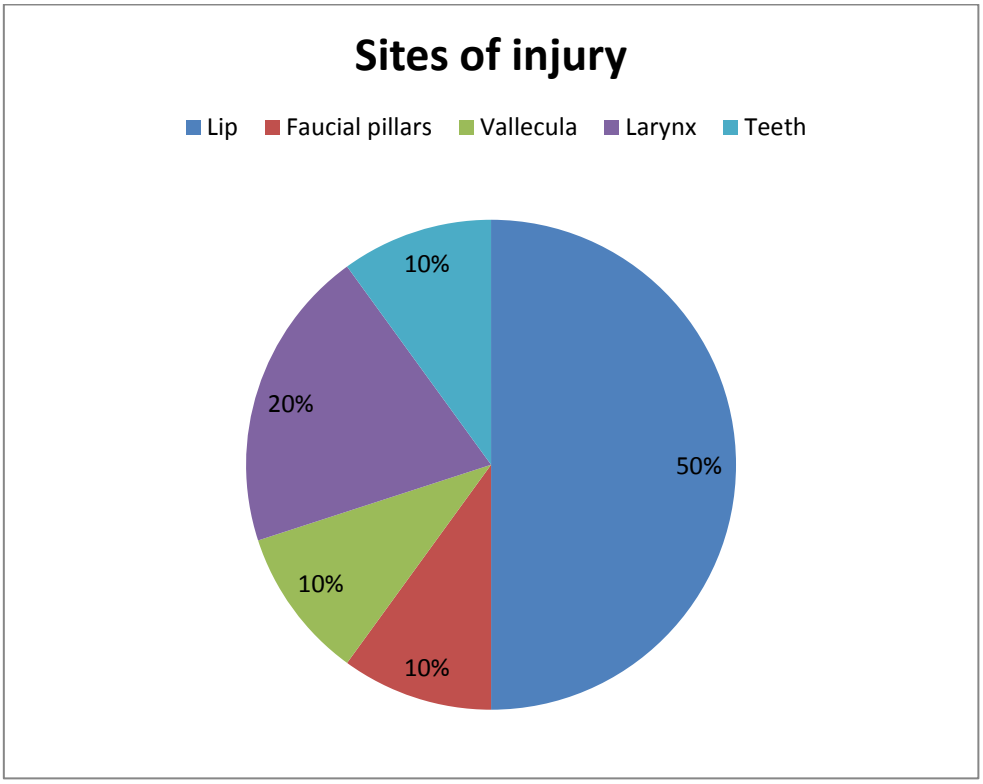

Figure 27. Sites of injury. Lip injury was the commonest.

Technical Difficulties encountered with the use of GVL

Technical difficulties were encountered in 24%.3% of all pateints had poor visualisation. 11% of all patientsencountered difficultyin directing the tubes towards the vocal cords. 9% of all patients had less working space and 2% of all patients were unable to maintain the scope in the midline. The incidence of difficulty in scope insertion and too deep an insertion of the scope was 1% of all patients for each.**Some of them had encountered multiple difficulties in one patient. That explains the incidence of 27 events in 21 patients.**

Table 17. Difficulties encountered while using GVL.

Majority of the study population did not have any difficulties.

Most commonly encountered difficulty in this study was difficulty in directing the tube towards the vocal cords.

Sno	Difficulties	Numbers(n=89)	Incidence
1.	No difficulty	68	76%
2.	Diffcult GVL	21	24%
	Poor visualisation	3	14%
	Difficulty in directing tube towards cords	10	48%
	Decreased working space	8	38%
	Difficulty in maintaining the scope in midline	2	10%
	Difficulty in scope insertion	1	5%
	Too deep insertion of the scope	1	5%
	Total difficult events	27	120%

Airway-trauma versus non airway-trauma cases

Age: The age of the population which had trauma was relatively higher than the non-trauma cases. This could be due to the fact that increasing age is associated with difficult airway and consequent increase in trauma.

Sex:There were equal number of males and females in the trauma group.

ASA status:Most patients were ASA II suggesting adequate optimisation of co-morbid illnesses prior to surgery.

Height, weight and BMI:Although, the mean height and weight was slightly lower in the trauma group it was not statistically significant. BMI was similar in both groups.

Arne score: There was no statistical significance on correlating Arne score with incidence of trauma.

Years of experience and GVL familiarity:The years of experience was slightly lower in the trauma group however it was not statistically significant. Most of the patients in the trauma group were intubated by anesthesiologist experienced in GVL scopy.

IDS:The incidence of trauma in patients with IDS≤5 was 11.8% (9/76)and the incidence of trauma in patients with IDS>5 was 7.6%(1/13). This is contrary to what is expected.

Time to visualise and intubate:These are longer in the trauma group demonstrating difficulty which predisposes to trauma.

***Difficult GVL*: It was significantly associated with trauma.(p-0.00)**

Table 18. Table comparing trauma cases with non-trauma cases.

Sn	Variable	Trauma		Non-trauma		P value
		No.	Values	No.	Values	
1.	Mean age(years)	10	**53±15**(31-82)	79	51±13(18-81)	0.59
2.	Males	5	50%	55	70%	0.21
	Females	5	50%	24	30%	
3.	ASA 1	4	40%	31	39%	0.18
	ASA 2	4	40%	44	56%	
	ASA 3	2	20%	4	5%	
4.	Mean height(cm)	10	**157±6**(145-165)	79	160±9(141-178)	0.33
5.	Mean weight(kgs)	10	**68±13**(44-83)	79	70±14(39-101)	0.75
6.	Mean BMI	10	27±5(21-35)	79	27±5(15-43)	0.82
7.	Arne score <11	4	40%	29	36%	0.26
	Arne score ≥11	6	60%	50	64%	0.06
8.	Years of experience	10	**5±2**(3-10)	79	6±3(3-14)	0.13
9.	GVL familiarity <20	4	40%	33	43%	0.89
	GVL familiarity >20	6	60%	43	57%	
10	IDS≤5	9	90%	67	85%	0.66
	IDS>5	1	10%	12	15%	
11	Seconds to visualise	10	**24±24(5-60)**	79	19±16(3-90)	0.58
12	Seconds to intubate	10	**50±30(10-113)**	79	46±25(7-150)	0.62
13	GVL Difficulties	9	**90%**	12	15%	**0.00**

Table 19. Incidence of difficulties in the trauma subset. The most frequently encountered difficulty was difficulty in directing tube towards the cords.

Difficulties encountered	Incidence (n=10)
Difficulty in directing tube towards the cord	6(60%)
Decreased working space	4(40%)
Difficulty in maintaining the scope in midline	1(10%)

The difficulty encountered in the patients who had trauma does not explain the cause for trauma. For example: lip injury in a patient in whom there was difficulty in directing tube towards the cord. This just means poor practice.

Difficult GVL laryngoscopy

Analysis of the difficult GVL group was done in comparison with easy GVL group. This revealed mean age higher in the difficult GVL group, suggesting increased incidence of difficult airway which is consistent with already existing evidence. There incidence of difficult GVL in patients with Arne score<11 was 12% (4/33) and in patients with Arne score ≥11 was 30% (17/56). This was statistically significant with a p value=0.05. This means that there is increased incidence of difficult GVL in patients with Arne score ≥11. The years of experience was significantly more in the easy GVL group (p=0.02) which implies that experience increases the quality of laryngoscopy. However, GVL familiarity did not have much impact on the incidence of difficulties. There was increased incidence of trauma in the difficult GVL group (p=0.00)

Table 20. Comparison of difficult GVL with the easy GVL population.

Sn	Variable	Difficult GVL		Easy GVL		P value
		N=21	Values	N=68	Values	
1.	Mean age(years)	21	**56±15(31-82)**	68	50±12(18-81)	0.07
2.	Males	14	67%	46	67%	0.93
	Females	7	33%	22	33%	
3	ASA status 1	7	20%	28	80%	0.27
	ASA status 2	11	23%	37	37%	
	ASA status 3	3	50%	3	3%	
4	Mean height(cms)	20	159±8(145-174)	65	160±9(141-178)	0.62
5	Mean weight(kgs)	20	67±11(44-83)	67	71±15(39-101)	0.27
6	Mean BMI	20	26±4(21-34)	66	28±5(15-43)	0.26
7	Arne score <11	4	19%	29	43%	**0.05**
	Arne score ≥11	17	**81%**	39	57%	
8	Years of experience	18	**5±2(3-10)**	55	6±3(3-14)	**0.02**
9	GVL familiarity<20	9	42%	28	41%	0.22
	GVL familiarity >20	12	58%	37	54%	
10	IDS≤5	16	76%	60	88%	0.17
	IDS>5	5	24%	8	12%	
11	Seconds to visualise	19	**26±24(3-90)**	67	17±13(3-60)	0.13
12.	Seconds to intubate	20	**50±26(10-113)**	68	45±25(7-150)	0.42
13.	Trauma	9	**43%**	1	1%	**0.00**

DISCUSSION

Management of difficult airway is always a challenge to anesthesiologists. The number of gadgets being developed to aid in the intubation of challenging cases is ever rising. With advancement in technology, there is a shift in trend from the conventional direct laryngoscopy, retrograde intubation etcetera to the newer modalities such as lighted intubating stylets, video-laryngoscopes and flexible fibre-optic bronchoscope. Of these, video-laryngoscopes have been promising.

Glidescope Video-Laryngoscope (GVL) which was the first to be introduced, is now being frequently used as the first attempt intubation device in anticipated difficult intubation scenarios as well as in normal airway cases.(39)However, it has its limitations. The use of glidescope is reported to cause significant airway trauma requiring surgical treatment. (6)(9)(8)(40). Thong et al have critically reviewed these cases and have provided methods to overcome difficulties with GVL and to minimise incidence of trauma(34) Magboul et al has also described in detail the blind spots of the GVL and possible injuries associated with the Gliderite stylet. (41)

Xue et al has reported incidence of complications with the use of GVL by experienced anesthesiologists with no prior experience in GVL as 3.4%(n=91).(42) The aim of the study was clinical assessment of GVL in oro-tracheal intubation under general anesthesia.1/3 of the patients in the study(n=27) had predicted difficult airway. Use of GVL in those patients improved the laryngeal view. But the assessment of injury was rather an incidental observation, than an active search.

Hence it was 3.4%. The subset analysis for the 27 patients with anticipated difficult airway was not provided.

In a study by Pournajafian et al, a randomised controlled trial of GVL versus Macintosh, no injury was found in the GVL group. The intubations were done by a single operator trained in the use of GVL on patients posted for elective surgery.

Although, such evidence is available in literature, in a training set up like ours, where GVL is often the first sought after equipment for anticipated difficult intubations by junior consultant anesthesiologists, the incidence of trauma has not been described. Therefore this study to estimate the incidence of complications was done. Another purpose of this study was to analyse whether correct practice by experienced anesthesiologists can decrease the incidence of trauma.

The statistics on upper airway trauma with direct laryngoscopy is 17% in patients anticipated to have difficult intubation and 63% in patient with actual difficulty in intubation.(42) The statistics of upper airway trauma in our study was 11.2%. It is significantly lesser than the incidence of trauma with macintosh laryngoscopes in patients with anticipated difficult airway cases. The incidence of trauma in the Xue et al study was only 3.4% (n=91). However, there was no mention of the sites of trauma and the reporting was made plainly based on the blood stains on the GVL. The evidence for trauma was not actively sought after. Also, the intubations were performed on mixed population with adequate airway and anticipated difficult airway. There were only 27 patients with difficult airway and if all the 3 cases with

trauma were from this group, the incidence would be way higher. Therefore the statistics of this study is not comparable to the Xue et al study.

Apart from airway trauma, there are many technical difficulties encountered with the use of GVL. These difficulties predispose the patients to airway trauma. To support this fact, our study resulted in higher incidence of trauma in the difficult GVL group. (p=0.00). The most common difficulty encountered was difficulty in directing the tube towards the vocal cords. (10/21). Among these 10 patients 6 of them had airway trauma.

Table 21. Sites of trauma in patients who had difficulty in directing tube towards vocal cords.

Site of injury	Numbers (n=6)
Lip	2
Faucial pillars	1
Larynx	2
Teeth	1

The mean age of the patients with airway trauma was higher. Though not statistically significant, it justifies already existing evidence that difficult intubation is more with increasing age. (Smitha et al study of difficult laryngoscopy and intubation in the indian population.)(43)

The mean time to intubate was longer in this study in comparison with the available stastistics of time taken to intubate with macintosh.(8±4seconds) This again confirms already existing data that intubation times are longer with GVL.(5)

2 patients had 2 attempts at GVL. In one patient there was too deep insertion of the size 4 blade which resulted in lifting up of larynx. In another patients there was desaturation while performing laryngoscopy due to pre-existing respiratory illness (OSAS). Therefore scope had to be removed for mask ventilation and laryngoscopy was attempted a second time by a more senior anesthesiologist.

The success rate of intubation with GVL by experienced anesthesiologists even in predicted difficult intubation was 100% in our study as opposed to Aziz et al study which had a success rate of 98% (44) In addition to this, the incidence of trauma in the hands of the experienced anesthesiologist was found to be much less. (p=0.02)

LIMITATIONS

1. Hawthorne effect: This is one's reaction in response to the knowledge of the fact that one is under observation. The efficiency seems to be greater than usual while under observation. This observation bias was unavoidable.
2. Due to availability of just one glidescope, patients were lost when included patients had to be induced simultaneously.
3. The time to intubate was influenced by many factors such as zero calibration of the gas module(time to intubate was prolonged), bronchospasm(delayed etCO2 trace due to bronchospasm therefore prolonged time to intubate)

CONCLUSIONS

Securing the airway quickly with minimal instrumentation extrapolates into good clinical practice. GVL may be one such equipment, which can improve laryngoscopic views and facilitate intubation in predicted difficult intubation. However, it has technical difficulties which may predispose the patients airway to trauma. A close adherence to the specifications in the conduct of Glidescope laryngoscopy can prevent this.

REFERENCES

1. Healy DW, Maties O, Hovord D, Kheterpal S. A systematic review of the role of videolaryngoscopy in successful orotracheal intubation. BMC Anesthesiol. 2012 Dec 14;12(1):32.
2. Turkstra TP, Craen RA, Pelz DM, Gelb AW. Cervical Spine Motion: A Fluoroscopic Comparison During Intubation with Lighted Stylet, GlideScope, and Macintosh Laryngoscope: Anesth Analg. 2005 Sep;101(3):910–5.
3. Amini S, Shakib M. Hemodynamic changes following endotracheal intubation in patients undergoing cesarean section with general anesthesia: application of glidescope® videolaryngoscope versus direct laryngoscope. Anesthesiol Pain Med. 2015 Apr;5(2):e21836.
4. Dashti M, Amini S, Azarfarin R, Totonchi Z, Hatami M. Hemodynamic changes following endotracheal intubation with glidescope(®) video-laryngoscope in patients with untreated hypertension. Res Cardiovasc Med. 2014 May;3(2):e17598.
5. Pournajafian AR, Ghodraty MR, Faiz SHR, Rahimzadeh P, Goodarzynejad H, Dogmehchi E. Comparing GlideScope Video Laryngoscope and Macintosh Laryngoscope Regarding Hemodynamic Responses During Orotracheal Intubation: A Randomized Controlled Trial. Iran Red Crescent Med J [Internet]. 2014 Apr [cited 2014 Jul 10];16(4). Available from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC4028761/
6. Malik AM, Frogel JK. Anterior Tonsillar Pillar Perforation During Glidescope?? Video Laryngoscopy: Anesth Analg. 2007 Jun;104(6):1610–1.

7. Cooper RM. Complications associated with the use of the GlideScope videolaryngoscope. Can J Anaesth J Can Anesth. 2007 Jan;54(1):54–7.

8. Hsu W-T, Hsu S-C, Lee Y-L, Huang J-S, Chen C-L. Penetrating Injury of the Soft Palate During GlideScope?? Intubation: Anesth Analg. 2007 Jun;104(6):1609–10.

9. Sharma D. Is GlideScope® the Best Way to Intubate?: Anesthesiology. 2010 Jul;113(1):258–9.

10. Rosenblatt WH, Sukhupragarn W. Airway management. Clin Anaesth Phila Lippincott Williams Wilkins. 2006;595–642.

11. Respiratory tract [Internet]. Wikipedia, the free encyclopedia. 2015 [cited 2015 Apr 18]. Available from: http://en.wikipedia.org/w/index.php?title=Respiratory_tract&oldid=649764177

12. Chaurasia BD. Human anatomy. 4th edition. New Delhi: CBS publisher;

13. Morgan Jr GE, Mikhail MS, Murray MJ. Clinical Anesthesiology. 4th edition. Lange;

14. Cormack RS, Lehane J. Difficult tracheal intubation in obstetrics. Anaesthesia. 1984 Nov;39(11):1105–11.

15. Cook TM. A new practical classification of laryngeal view. Anaesthesia. 2000 Mar;55(3):274–9.

16. Wyatt LH, Ferrance RJ. The musculoskeletal effects of diabetes mellitus. J Can Chiropr Assoc. 2006 Mar;50(1):43–50.

17. AA B, IS K, J H, JE C. Clinical anaesthesia. 5th edition. Philadelphia: Lippincott Williams and Wilkins; 2006. 775-6 p.

18. Ul Haq MI, Ullah H. Comparison of Mallampati test with lower jaw protrusion maneuver in predicting difficult laryngoscopy and intubation. J Anaesthesiol Clin Pharmacol. 2013;29(3):313–7.

19. Gupta S, Sharma R, Jain D. Airway assessment: predictors of difficult airway. Indian J Anaesth. 2005;49(4):257–62.

20. Tiberiu Ezri RDW. The incidence of class "zero" airway and the impact of Mallampati score, age, sex, and body mass index on prediction of laryngoscopy grade. Anesth Analg. 2001;93(4):1073–5, table of contents.

21. Bellhouse CP, Doré C. Criteria for estimating likelihood of difficulty of endotracheal intubation with the Macintosh laryngoscope. Anaesth Intensive Care. 1988 Aug;16(3):329–37.

22. Savva D. Prediction of difficult tracheal intubation. Br J Anaesth. 1994 Aug 1;73(2):149–53.

23. Chou HC, Wu TL. Mandibulohyoid distance in difficult laryngoscopy. Br J Anaesth. 1993 Sep;71(3):335–9.

24. Reissell E, Orko R, Maunuksela E-L, Lindgren L. Predictability of difficult laryngoscopy in patients with long-term diabetes mellitus. Anaesthesia. 1990 Dec 1;45(12):1024–7.

25. Kulkarni AP, Divatia J, Patil VP, Gehdoo R. Objective Anaesthesia Review: A Comprehensive Textbook for the Examinees. Third. JP Medical Ltd; 2013. 155 p.

26. White A, Kander PL. Anatomical factors in difficult direct laryngoscopy. Br J Anaesth. 1975 Apr;47(4):468–74.

27. Wilson ME, Spiegelhalter D, Robertson JA, Lesser P. Predicting difficult intubation. Br J Anaesth. 1988 Aug;61(2):211–6.

28. el-Ganzouri AR, McCarthy RJ, Tuman KJ, Tanck EN, Ivankovich AD. Preoperative airway assessment: predictive value of a multivariate risk index. Anesth Analg. 1996 Jun;82(6):1197–204.

29. Arné J, Descoins P, Fusciardi J, Ingrand P, Ferrier B, Boudigues D, et al. Preoperative assessment for difficult intubation in general and ENT surgery: predictive value of a clinical multivariate risk index. Br J Anaesth. 1998 Feb;80(2):140–6.

30. Reed MJ, Dunn MJG, McKeown DW. Can an airway assessment score predict difficulty at intubation in the emergency department? Emerg Med J EMJ. 2005 Feb;22(2):99–102.

31. Apfelbaum JL, Hagberg CA, Caplan RA, Blitt CD, Connis RT, Nickinovich DG, et al. Practice Guidelines for Management of the Difficult Airway: An Updated Report by the American Society of Anesthesiologists Task Force on Management of the Difficult Airway. Anesthesiology. 2013 Feb;118(2):251–70.

32. User's Manual & Quick Reference Guide GlideScope® GVL and Cobalt [Internet]. Available from: http://verathon.com/Portals/0/Uploads/ProductMaterials/GS_GVL_UsersManual.pdf

33. FRCSc DJPM. Glidescope Jack: Overview of the GlideScope history [Internet]. [cited 2015 Aug 6]. Available from: http://glidescopejack.blogspot.in/2012/02/overview-of-glidescope-history.html

34. Thong SY, Goh SY. Reported complications associated with the use of GlideScope® video laryngoscope–How can they be prevented? OA Anaesth. 2013;1(1):1.

35. Carassiti M, Zanzonico R, Cecchini S, Silvestri S, Cataldo R, Agrò FE. Force and pressure distribution using Macintosh and GlideScope laryngoscopes in normal and difficult airways: a manikin study. Br J Anaesth. 2012 Jan;108(1):146–51.

36. Bathory I, Frascarolo P, Kern C, Schoettker P. Evaluation of the GlideScope® for tracheal intubation in patients with cervical spine immobilisation by a semi-rigid collar. Anaesthesia. 2009 Dec 1;64(12):1337–41.

37. Hirabayashi Y, Otsuka Y. Apparent blind spot with the GlideScope® video laryngoscope. Br J Anaesth. 2009 Sep 1;103(3):461–2.

38. Adnet F, Borron SW, Racine SX, Clemessy JL, Fournier JL, Plaisance P, et al. The intubation difficulty scale (IDS): proposal and evaluation of a new score characterizing the complexity of endotracheal intubation. Anesthesiology. 1997 Dec;87(6):1290–7.

39. Stanley GD. Is It Time for a Glidescope Letter?: Anesthesiology. 2009 Dec;111(6):1391.

40. Hsu W-T, Tsao S-L, Chen K-Y, Chou W-K. Penetrating injury of the palatoglossal arch associated with use of the GlideScope videolaryngoscope in a flame burn patient. Acta Anaesthesiol Taiwanica Off J Taiwan Soc Anesthesiol. 2008 Mar;46(1):39–41.

41. Magboul MMA, Joel S. The video laryngoscopes, blind spots and retromolar trigonum injury by the GlideRite® rigid stylet. Anesth Essays Res. 2010;4(2):112–4.

42. Xue FS, Zhang GH, Liu J, Li XY, Yang QY, Xu YC, et al. The clinical assessment of Glidescope in orotracheal intubation under general anesthesia. Minerva Anestesiol. 2007 Sep;73(9):451–7.

43. Prakash S, Kumar A, Bhandari S, Mullick P, Gogia A, Singh R. Difficult laryngoscopy and intubation in the Indian population: An assessment of anatomical and clinical risk factors. Indian J Anaesth. 2013;57(6):569.

44. Aziz MF, Healy D, Kheterpal S, Fu RF, Dillman D, Brambrink AM. Routine clinical practice effectiveness of the Glidescope in difficult airway management: an analysis of 2,004 Glidescope intubations, complications, and failures from two institutions. Anesthesiology. 2011 Jan;114(1):34–41.

ANNEXURES

PATIENT INFORMATION SHEET

CHRISTIAN MEDICAL COLLEGE, VELLORE

DEPARTMENT OF ANESTHESIOLOGY

This informed consent is for patients with anticipated difficult airway management for whom Glidescope Video Laryngoscope (GVL) will be used for the study titled, to determine the incidence of complications associated with the use of Glidescope Video Laryngoscope in patients with anticipated difficult airway.

Name of the Principal Investigator: Dr. Mary Benita Jeyakumar

Name of Organisation: Christian Medical College, Vellore.

Name of proposal: To determine the incidence of complications associated with the use of Glidescope Video Laryngoscope in patients with anticipated difficult airway.

Introduction: I am Dr. Benita, MD post graduate in the department of anaesthesia, with three years of experience in this field. I am doing a study to estimate the incidence of complications with the use of glidescope, an equipment used to insert a tube into the windpipe to support breathing when a patient is unconscious under general anaesthesia. You can read the following

information about the study and decide on whether you want to participate in this study or not. If you have any difficulty in understanding any part of the information sheet, please feel free to ask me.

Purpose of research: General anesthesia is given to patients who require certain surgical procedures in order to prevent them from remembering the unpleasant surgical pain and also to make certain surgeries convenient. It is a state of unconsciousness intentionally induced using certain drugs. During this state, breathing is initiated through an equipment called as the ventilator. This ventilator breathes for the patient through a tube inserted into the patient's lung. In some patients inserting this tube may be difficult due to various reasons. In order to overcome this difficulty many devices have been invented. One such device is the glidescope video laryngoscope (GVL). This helps to visualize the structures of the throat, through which the tube can be inserted. This study aims to determine incidence of injuries with the use of this equipment. If it is significant, a solution needs to be sought to prevent injuries.

Participant selection: You have been invited to participate in this study because you fall into the group of people in whom inserting the tube is difficult. There will be 234 patients participating in this study. You are requested to participate in the study only at the time of initiation of anesthesia.

Voluntary participation: Your participation in this study is entirely voluntary. Whether you participate in this study or not, the anesthestic plan, management and safe recovery will not change.

Information on the equipment: Glidescope is one of the equipments used to visualize the structures of the throat to facilitate insertion of a tube through it for providing oxygen while the patient is unconscious under general anaesthesia. It has a video camera at the tip which is connected to a monitor which displays what the camera captures. It is therefore said to make the tube insertion easy.

Procedures and protocol: On the day of surgery, an IV line will be inserted in one of your hands. Drugs will be given through it to put you to sleep. After you have slept, the glidescope will be used as per the manufacturer's guide and the tube will be inserted into the windpipe. Any problems encountered will be recorded.

Risks: There can be injury to the mouth and throat with the current knowledge. The frequency of the occurrence of these injuries associated with this particular equipment is what this study aims to find out.

Benefits: The benefits of participating in this study would be to help acquire new knowledge about this equipment which can modify future patient care. You do not have direct benefits from participating in this study.

Reimbursements: Only the usual charges for the use of the equipment will be charged. No reimbursements will be made.

Confidentiality: Your identity will remain confidential. Only the investigators of the study will know your identity. Confidentiality will be maintained by number coding the proforma and the data sheet. The final analysis and write up of the study will also not mention your identity.

Sharing of the result: The results of the study is entitled to publication or presentation in conferences.

Right to refuse or withdraw: You are free to refuse participating in this study. You are also free to withdraw from the study at any point without any compromise to your medical treatment.

This proposal has been reviewed and approved by IRB, a committee which ensures safety of patients participating in research.

For clarifications you can contact

Dr. Benita

Mobile no. 09566401012

E-mail id. mbj.benta@gmail.com

Date: 04/02/2015

ग्लाइडस्कोपमेंजटिलताकाअध्ययन: सूचनापत्र

परिचयः- मैंडा0 मैरीबेनिताहूँ।मैंसंवेदनाहरणविभागमेंएम0डी0 पारास्नातकहूँजहाँमुझेतीनवर्षकाअनुभवहै।हमग्लाइडस्कोपकेप्रयोगमेंहोनेवालेजटिलताकीघट नाकाअध्ययनकररहेहैं।जबरोगीसामान्यसंवेदनाहरित ;अचेतद्धअवस्थामेंहोताहैतबइसकाप्रयोगष्वासलेनेमेंसहायताकेलिएष्वासनलीकोविंडपाइप ;वायनलीद्धमेंप्रविष्टकरानेमंे कियाजाताहै।कृप्याअध्ययनकेबारेमेंनिम्नलिखितसूचनाकोपढे जिससेआपकोयहनिर्णयकरनेमंे सहायतामिलेगीकिआपयाआपकेसंबंधीइसअध्ययनमेंभागलें गेयानहीं।अगरआपकोइससूचनापत्रकेकिसीभीभागकोसमझनेमेंकठिनताहोतोआपस्वतंत्रतापूर्व कप्रष्नपूछसकतेहै।

षोधकेउद्देष्यः- सामान्यसंवेदनाहरणरोगीकोएकनिष्चितषल्य-चिकित्सकीयप्रक्रियाकेफलस्वरूपहोनेवालेदुखदायीषल्य-चिकित्सकीयपीड़ाकोस्मरणनरखपानेऔरषल्यचिकित्साकोसुविधाजनकबनानेकेलिएदियाजा ताहै।यहरोगीकेबिनाप्राकृतिकष्वासकेअचेतअवस्थामेंलानेकेलिएउपचारहै।ष्वासकोबनाएरखने केलिएवेंटिलेटरनामकउपकरणकाप्रयोगकियाजाताहै।रक्तमेंऑक्सीजनकीमात्रासामान्यबनाए रखनेकेलिएवेंटिलेटरएकनलीजोरोगीकेफेफड़ेमेंप्रविष्टकरायाजाताहै, केद्वाराकृत्रिमतरीकेसेसाँसलेताहै।कुछरोगीमेंइसनलीकोप्रविष्टकरानेमेंकठिनाईहोतीहै, जिनकेनिम्नलिखितकारणहैं।सामान्यसंवेदनाहरितस्थितिमेंजबरोगीअचेतहोजाताहैऔरसाँस लेनाबन्दकरदेताहैउसस्थि[a]तिमेंअगरयहनलीटै किया ;ष्वासनलीद्धतकप्रविष्टनहींकरायागयातोरक्तमेंऑक्सीजनकीमात्रामेंकमीहोसकतीहैजिससेरो गीकेमष्तिष्ककोक्षतियामृत्युहोसकतीहै।अतएवष्वासनलीकोषीघ्रतासेफेफड़ेमेंसुरक्षितप्रविष्टक रनाअतिमहत्वपूर्णहै।इसकठिनाईकोदूरकरनेकेलिएकईयंत्रोकाआविष्कारकियागयाहै।इनमेंसेए कहैग्लाइडस्कोपविडियोलेरिन्गोस्कोप ;जी0वी0एल0द्धयहगलेकीसंरचनाजिससेनलीकोप्रविष्टकरायाजाताहै, कोदिखानेमेंमददकरताहै।

हालकीरिपोर्टकेअनुसारइसयंत्रकेउपयोगसेरोगीकेमुँहऔरदांतइत्यादिमेंचोटपहुँचतीहै, जिससेकभी -2
षल्यचिकित्साकेहस्तक्षेपकीआवष्यकताहोतीहै।इनआघातोंकाकारणयातोजी0वी0एल0 केप्रयोगकीसहीतकनीकीज्ञानकाआभावहैयावास्तविकमेंजी0वी0एल0 कोप्रयोगमेंलानाकठिनहै।इसअध्ययनकालक्ष्यआघातोंऔरउनकेकारणोंकापतालगानाहै।अगर यहमहत्वपूर्णहैतोआघातोंकोरोकनेकेलिएसमाधानकापतालगानेकीआवष्यकताहै।

<u>प्रतिभागीकाचयनः-</u>

इसअध्ययनमेंभागलेनेकेलिएआपसभीआमंत्रितहैं।आपएकसर्जरीमेंभागलेनेवालेहैजिस मेंआपकोअचेत ;बेहोषद्धकियाजाएगाहमारेमूल्यांकनकेअनुसारअचेतअवस्थामेंनलीडालनेकीप्रकियामेंकठिनाई आसकतीहै।अतएवआपपरहमग्लाइडस्कोपकाप्रयोगकरनेवालेहै।

<u>स्वैच्छिकभागीदारीः-</u>

इसअध्ययनमेंआपकीभागीदारीपूर्णरूपसेस्वैच्छिकहै।आपकेभागलेनेयानालेनेपरसंवेद नाहरणयोजनाप्रबंधनऔरसुरक्षितबचावमेंकोईबदलावनहींहोगा।

<u>उपकरणकीजानकारीः</u>-

ग्लाइडस्कोपएकऐसाउपकरणहैजोगलेकीसंरचनाकोदिखानेमेंमददकरताहै।इससेनली कोगलेमेंप्रविष्टकरानेमेंसहायतामिलतीहैजिससेसामान्यसंवेदनाहरितअवस्थामेंअचेतरोगीको ऑक्सीजनप्रदानकियाजासके।

<u>प्रक्रियाएवंनियम ;प्रॉटोकॉलद्धः</u>- षल्यचिकित्साकेसमयएकआई0 वी0 लाइनआपकेएकहाथमेंप्रविष्टकरायाजाएगा।आपकोसुलानेकेलिएइसकेमाध्यमसेदवादीजाएगी

।आपकेनीद्रामेंजानेकेबादमानकनियमांेकेतहतविंडपाइपमेंनलीकोप्रविष्टकरानेकेलिएग्लाइड स्कोपकाप्रयोगकियाजाएगा।अगरकोईकठिनाईआतीहैतोउसेदर्जकियाजाएगा।

<u>खतराः</u>-

पारंपरिकउपकरणद्वारानलीकीप्रविष्टिसेएकनिष्चितआघातकीघटनाहोसकतीहै।इस विषेषउपकरणकेप्रयोगसेहोनेवालेखतरेकापतालगानाहीअध्ययनकालक्ष्यहै।

<u>लाभः</u>-

इसअध्ययनमेंभागीदारीसेइसउपकरणकेबारेमेंनईजानकारीकालाभमिलेगाजिससेभवि ष्यमेंरोगीकीसंषोधितदेखभालकीजासकेगी।आपकोइसअध्ययनसेप्रत्यक्षलाभनहींमिलेगा।

<u>प्रतिपर्तिः-</u>

उपकरणकेप्रयोगकेलिएव्यवहारिकप्रभारहीलियाजाएगा।कोईप्रतिपर्तिनहींमिलेगी।

<u>गोपनीयताः-</u>

आपकीपहचानगोपनीयरखीजाएगी।आपकीपहचानकेबारेमेंसिर्फअध्ययनकेअन्वेष्ककी हीपताहोगा।प्रफार्मा
;प्रपत्रद्धऔरसूचनापत्रकोकूटसंख्यामेंबदलकरगोपनीयरखाजाएगा।अंतिमविष्लेषणऔरप्रषंषा त्मकविवरणमेंभीआपकेपहचानकाउल्लेखनहींहोगा।

<u>परिणामकीहिस्सेदारीः</u>-

इसअध्ययनकेपरिणामकोप्रकाषितयासम्मेलनमेंप्रस्तुतकियाजाएगा।

<u>इन्कारयाअलगहोनेकाअधिकारः</u>-

आपइसअध्ययनमेंभागलेनेसेइन्कारकरनेमेंस्वतंत्रहै।आपइसअध्ययनसेकिसीभीसमयऔरबि नाकिसीचिकित्साउपचारकेसमझौतेकेअलगहोसकतेहै।

इसप्रस्तावकीसमीक्षाऔरसहमतिहमारेसंस्थानसमीक्षासमीति,
जोषोधमेंभागलेनेवालेरोगीकीसूरक्षातयकरतीहै, केद्वाराकीगईहै।

स्पष्टीकारणकेलिएसम्पर्ककरें:-

डा0 मैरीबेनिता ;प्रधानअन्वेषक

मो0:- 09566401012

ई0 मेल:- उइरण्इमदजं/हउंपसण्बवउण्

<u>கிலைட்ஸ்கோப்பக்கவிளைவுகள் - விவரதாள்</u>

<u>அறிமுகம்</u>: என்பெயர்டாக்டர். மேரிபெனிடா. நான்மயக்கமருந்துதுரையில்படித்துவருகிறேன். இதில்எனக்கு 3 ஆண்டுகள்அனுபவம்உண்டு.
மருந்துகளால்மயக்கநிலையில்இருக்கும்நோயாளிக்குசுவாசமளிக்கசுவாசகுழாயில்ஒருகுழாய்செலுத்தபடும்.
இந்தகுழாயைசெலுத்தகிலைட்ஸ்கோப்என்னும்ஒருஉபகரணம்உபயோகிக்கபடுகிறது.
கிலைட்ஸ்கோப்பினால்எற்படும்பக்கவிளைவுகளைதீர்மானிக்கஒருஆராயிச்சிநடத்தபடுகிறது. அதைக்குறித்தகீழுள்ளவிவரதாளைவாசித்துபின்னர்இந்தஆராய்வில்பங்கேற்கலாமாவேண்டாமாஎன்றுமுடிவுசெய்யாலாம்.
சந்தேகங்கள்இருந்தால்என்னைகேட்க்கதயங்காதீர்கள்.

<u>ஆராய்வின்நோக்கம்</u>:
அறுவைசிகிச்சையினால்ஏற்படும்விரும்பத்தகாதவலியைநீக்கமயக்கமருந்துகொடுக்கப்படுகிறது.

மருந்துகளால்உருவாக்கப்படும்இந்தமயக்கநிலையில்இருக்கும் நோயாளிக்குசுவாசமளிக்கசுவாசகுழாயில்ஒருகுழாய்செலுத்தபடும்.

இந்தகுழாய்வழியாகவென்டிலெடர்என்னும்உபகரணம்சுவாசமளிக்கும்.

இந்தகுழாயைசெலுத்துவதுஒருசிலரில்கடினமாகஇருக்கலாம். கடினங்களைமேற்கொள்ள்பலஉபகரணங்ள்கண்டுப்பிடிக்கப்பட்டுள்ளது. அதில்ஒன்றுகிலைட்ஸ்கோப்பகும். சுவாசகுழாயின்வடிவமைப்பைகாட்சிபடுத்திசுவாசம்மளிக்கும்குழாயைஅதில்செலுத்தஇதுஉதவுகிறது. இவ்வாராய்வு கிலைட்ஸ்கோப்பினால்எற்படும்பக்கவிளைவுகளைதீர்மானிக்க முயல்கிறது.

விளைவுகள்குறிப்பிடத்தக்கதாகயிருந்தால்அதனைதவிர்க்கநடவடிக்கைகள்எடுக்கபடும்.

<u>பங்கேற்போர்விவரம்</u>:

சுவாசமளிக்கும்குழாயைசெலுத்துவதுஉங்களுக்குகடினமாகஇருக்கும்எனஎதிப்பார்க்கப்படுகிறது.

அதனால்இந்தஆரய்வில்பங்கேற்க்க்நீங்கள்அழைக்கப்படுகிறீகள்.

<u>தன்னார்வபங்கேற்பு</u>:இதில்பங்கேற்ப்பதுஉங்கள்சுயவிருப்பதினால்மட்டுமே.

நீங்கள்பங்கேற்க்கவில்லைஎன்றாலும்உங்களுக்குஅளிக்கப்படும் மயக்கமருந்துதிட்டதில்மாற்றம்எதுவும்இருக்காது.

<u>உபகரணத்தின்விவரம்:</u>கிலைட்ஸ்கோப்,
சுவாசகுழாயின்வடிவமைப்பைகாட்ச்சிப்படுத்தி,
சுவாசமளிக்கும்குழாயைசுலபமாகசெலுத்தஉதவுகிறது.
அதின்நூனியில்ஒருவீடியோகேமராபொருத்தப்பட்டுள்லது.
ஒருஇண்ணைப்பின்மூலம்காட்சிபெட்டியில்சுவாசகுழாயின்வடி வமைப்புகாண்பிக்கப்படும்.
அதினால்சுவாசமளிக்கும்குழாயைசெலுத்துவதுசுலபமாக்கப்படுகி றது.

<u>செயல்முறைகள்:</u>அறுவைசிகிச்சைஅன்றுஉங்கள்கையிலுள்ளநர ம்பில்ஒருஉசியிடப்படும்.
அதின்வழியாகமயக்கமருந்துகோடுக்கப்படும்.
நீங்கள்மயக்கத்தில்இருக்கும்போதுகிலைட்ஸ்கோபைபயன்படுத் திசுவாசமளிக்கும்குழாயைசுவாசகுழாயில்செலுத்திசுவாசம்அளி க்கப்படும். பிரச்சனைகள்நேரிட்டால்குறிக்கப்படும்.

<u>அபாயங்கள்:</u>இவ்வுபகரணத்தால்எற்படும்விளைவுகளைகன்டறி வதேஇந்தஆய்வின்நோக்கம்.

<u>நன்மைகள்</u>:
இதனால்உங்களுக்குநேரடியாகஒருநன்மையும்இல்லைஎன்றாலு ம்இந்தஆய்வின்முடிவில்இந்தஉபகரணத்தின்விளைவுகளைப்பற் றியஅறிவு,
மேற்கோண்டுஉபயோகிக்கப்படும்நோயளிகளுக்குவிளைவுகளின் றிஉபயோகிக்கஉதவும்.

ஈடுகள்:
கிலைட்ஸ்கோபைபயன்படுத்துவதர்கானசெலவுகள்மட்டுமேவசூலிக்கப்படும். ஈடுகள்எதுவும்தரப்படாது.

நம்பிக்கைவாக்கியம்:
உங்கள்அடையாளம்எக்காரணத்தைக்கொண்டும்யாருக்கும்அறிவிக்கப்படாது. உங்களுக்குஒருஎண்அளிக்கப்படும். அந்தஎண்ணாககுறிப்பிடப்படுவீர்கள்.
ஆராய்வின்முடிவிலும்உங்கள்அடையளாம்ரகசியமாகவைக்கப்படும்.

முடிவுகள்:
ஆராய்வின்முடிவுகள்மருத்துவஇதழ்களிலும்மருத்துவமாநாடுகளிலும்வெளியிடஅனுமதிஉண்டு.

உரிமைகள்:இவ்வராய்வில்பங்கேற்க்கமறுக்கஉங்களுக்குஉரிமைஉண்டு.
இதிலிருந்துஎப்பொதுவேண்டுமானாலும்விலகிக்கொள்ளலாம்.
அதனால்உங்கள்மருத்துவசேவைக்குஎந்தபாதிப்பும்இருக்காது.

இந்தஆய்வைநடத்தஐ.அர்.பிகமிடியின்சம்மதம்பெறப்பட்டுள்ளது.
ஐ. அர். பிகமிடியின்குறிகோள், ஆராய்வில்பங்கேற்கும்நோயாளிகளின்பாதுகாப்பாகும்.

சந்தேகங்களுக்கு,

டாக்டர். மேரிபெனிடா.

தொலைபேசி: 09566401012

மின்னஞ்சல் - mbj.benta@gmail.com

CONSENT FORMS

Informed consent

Study Title: Glidescope complications study

Study Number:

Subject's Initials: _____ Subject's Name: _____

Date of Birth / Age:_____

Please initial box

(Subject)

(i) I confirm that I have read and understood the information sheet dated _____ for the above study and have had the opportunity to ask questions. [ ]

(ii) I understand that my participation in the study is voluntary and that I am

free to withdraw at any time, without giving any reason, without my medical care or legal rights being affected. [ ]

(iii) I understand that the Sponsor of the clinical trial, others working on the Sponsor's behalf, the Ethics Committee and the regulatory authorities will not need my permission to look at my health records both in respect of the current study and any further research that may be conducted in relation to it, even if I withdraw from the trial. I agree to this access. However, I understand that my identity will not be revealed in any information released to third parties or published. [ ]

(iv) I agree not to restrict the use of any data or results that arise from this study provided such a use is only for scientific purpose(s) [ ]

(v) I agree to take part in the above study. [ ]

Signature (or Thumb impression) of the Subject/Legally Acceptable Representative:_____

Date: _____/_____/_____

Signatory's Name: _____

Signature of the Investigator: _____

Date: _____/_____/_____

Study Investigator's Name: _____

Signature of the Witness: _____

Date:_____/_____/_____

Name of the Witness: _____

अवगतसहमति

अध्ययनशीर्षक: गलैडसकोपजटिलताओंकाअध्ययन

स्टडीसंख्या:

रोगीकेपहलेअक्षर : _____ रोगीकानाम: _____

जन्मदिवस/ आयु : _____

कृपयाबॉक्सकोटिककरें

(i) मैंनेसूचनापत्रकदिनांकित _____
पढ़ाऔरसमझाहैऔरउपरोक्तअध्ययनकेलिएमुझेसवालपूछनेकाअवसरमिलाहै। [ ]

(ii) मैंसमझताहूँकिइसअध्ययनमेंमेरीभागीदारीस्वैच्छिकहैऔरमैंबिनाकोईकारणबताए , किसीभीसमय , मेरीचिकित्सादेखभालयाकानूनीअधिकारकेनि:शुल्कबिनाप्रभावितहुऐ, अपनीभागीदारीवापसलेसकताहूँ। [ ]

(iii) अगरमैंपरीक्षणसेवापसलेनाचाहू , चिकित्सीयपरीक्षणकेप्रायोजक , प्रायोजककीओरसेकामकररहेअन्यलोगों, आचारसमितिऔरनियामकअधिकारियोंवर्तमानअध्ययनकेलिएमेरीचिकितसाजानकारीअनुसंधानकेलिएमेरीअनुमतिकीजरूरतनहींहोगी।मैंइसकेउपयोगकरनेकेलिएसहमतहूँ।हालांकि, मैंसमझताहूकिमेरीपहचानतीसरेपक्षकोजारीयाप्रकाशितकिसीभीजानकारीमेंखुलासानहींकिया जाएगा। [ ]

(iv)
मैंइसअध्ययनसेउठनेवालीकिसीभीडेटायापरिणामकोवैज्ञानिकउद्देश्यकेइस्तेमालकेलिएसहमत हूँ। [ ]

(v) मैंऊपरदीएगएअध्ययनमेंभागलेनेकेलिएसहमतहूँ। [ ]

विषय / कानूनीतौरपरस्वीकार्यप्रतिनिधिकेहस्ताक्षर (याअंगूठेकानिशान): _____

दिनांक: _____ / _____ / _____

हस्ताक्षरकर्ताकानाम: _____

अन्वेषककेहस्ताक्षर: _____

दिनांक: _____ / _____ / _____

अध्ययनजांचकर्ताकानाम: _____

गवाहकेहस्ताक्षर: _____

दिनांक: _____ / _____ / _____

गवाहकानाम: _____

ஒப்புதல்வாக்கியம்

ஆராயிச்சியின்தலைப்பு:கிலைட்ஸ்கோப்உபயோகதினால்ஏற்படும்பக்கவிளைவுகளின்நிகழ்வைதிர்மானிக்கும்ஒருஆய்வு.

ஆராயிச்சிஎண்:

பங்குபெறுவோர்பெயர்:

வயது/பிறந்தநாள்:

குறிப்பிடவும்

1. _____என்றுதேதியிடப்பட்டஇதனைகுறித்தவிவரதாளைபுரிந்துகொண்டுபடித்திருகிறேன்என்றுஉறுதிஅளிக்கிறேன். சந்தேகங்கள்கேட்கஅனுமதிகொடுக்கப்பட்டதுஎன்றும்உறுதிஅளிக்கிறேன் [ ]
2. இதில்பங்கேற்ப்பதுஎன்சுயவிருப்பதினால்மட்டுமேஎன்றும்இதிலிருந்துஎப்போதுவேண்டுமானாலும்காரணம்எதுவும்சொல்லாமல்விலகிக்கொள்ளலாம்என்றும்அதினால்என்மருத்துவசேவையும்என்சட்டஉரிமைகளும்பாதிக்கப்படாதுஎன்றும்அறிந்திருக்கிறேன் [ ]
3. மருத்துவ விசாரணை ஸ்பான்சர், ஸ்பான்சர் சார்பாக வேலை செய்வோர், ஒழுக்கவியல் குழு மற்றும் கட்டுப்பாட்டு அதிகாரிகளுக்குதற்போது நடத்தப்படும்ஆராய்ச்சிமட்டுமன்றுஇதுசம்பந்தமாக மேலும் நடத்தப்படும்எந்த ஆராய்ச்சிகாகவும் என் மருத்துவ பதிவுகளை பார்க்க என் அனுமதி தேவையில்லை என்று

புரிந்துகொள்கிறேன். நான் ஆராய்ச்சியிலிருந்து விலகிக்கொண்டால் கூட இந்த அணுகலுக்குஒப்புக்கொள்கிறேன். எனினும் , என் அடையாளம் மூன்றாவது
நபர்களுக்கும்வெளியீடுகளிலும்அறிவிக்கப்படாதுஎன்று புரிந்துகொள்கிறேன். [ ]

4. இந்தஆராயிச்சியின்தகவல்கள்மற்றும்முடிவுகள், மருத்துவகாரணஙளுக்காகபயன்ப்படுத்தப்படஒப்புகொள்கிறேன் [ ]
5. மேல்குறிப்பிடப்பட்டஆய்வில்பங்கேற்க்கசம்மதிக்கிறேன் [ ]

பங்கேற்போர் / சட்டபூர்வமாகஏற்றுக்கொள்ளப்பட்டபிரதிநிதியின்கையொப்பம் (அல்லதுகைநாட்டு):

தேதி: _____ / _____ / _____

பெயர்: _____

ஆராய்ச்சியாளரின்கையொப்பம்:

தேதி: _____ / _____ / _____

ஆராய்ச்சியாளரின்பெயர்: _____

சாட்சியின்கையொப்பம்:

தேதி: _____ / _____ / _____

சாட்சியின்பெயர்: _____

PROFORMA

Name : Age: Sex:

H. No: Ht: Wt: BMI:

ASA Grade: Mention co-morbid illnesses:

Surgical diagnosis:

1	**Indication for glidescope use**	□ MP class III/IV		
		□ Limited neck movt		
		□ Others		
2	**Years of experience of intubating anaesthetist:**			
	Designation:	□ Consultant □ PG		
3	**Approximate no. of previous glidescope intubations performed:**	□<10	□ 10-20	□>20
4	**Difficulty in visualising the glottis**	□ Yes □ No		
5	**N1 – No. of attempts > 1** **(Every additional attempt gets one point)**			
	N2 – No. of operators >1 **(Each additional operator gets one point)**			
	N3 – No. of alternative techniques used - **Repositioning the patient(ramping, propped up position)** - **Change of material(blade, ETT size, stylet, bougie)** - **Use of another technique(fibreoptic, ETT thru LMA, McCoy)** - **Change in approach(nasal)** **(Each alternative techniques used adds one point)**			
	N4 – Cormack- Lehane grading - **CL I – 0** - **CL II – 1** - **CL III – 2** - **CL IV - 3**			
	N5 – Lifting force - **[Normal – 0]** - **[Increased – 1]**			
	N6 – Laryngeal pressure - **[Not applied – 0]** - **[Applied – 1]**			
	N7 – Vocal cord mobility - **[Abduction – 0] [Adduction – 1]**			
	INTUBATION DIFFICULTY SCORE			
6	**a. Time to visualise**			

	b. Time to intubate (Time of visualisation of the cords till the time of satisfactory etCO2 trace)	
7	**a. Was oxygenation maintained throughout**	
	b. If not, how long was the oxygenation low?	
8	**TRAUMA**	□ Yes □ No
	Which part of the airway was injured ?	□ Soft tissue of the oral cavity (Lips, Tongue, Faucial pillars, Vallecula, Pharyngeal walls, Soft palate, Uvula) □ Injury to teeth □ Injury to the larynx (Epiglottis, Arytenoids, Cords)
	Was there cuff injury?	□ Yes □ No
9	**What was the cause for trauma?**	□ Poor visualisation
		□ Decreased working space
		□ Inability to direct tube towards cords(stylet angulation)
		□ Instability of the scope
		□ Others – mention please
10	**How was trauma managed?**	□ Conservative
		□ Surgical

DATA

S No.	age	sex	ht	weight	BMI	surgical diagnosis	ASA	Arne score	years of experience of intubating anesthetist	Attempts at glidescope intubation 1= <10 2= 10-20 3= >20
1	49	M	165	72	26.4	LUNG	1	12	5	3
2	58	M	161	60	23.1	ABDO	2	21	5	2
3	45	M	170	55	19	SPINE	3	13	5	3
4	61	F	148	76	34.7	ABDO	2	17	6	2
5	66	F	145	74	35.2	ABDO	3	16	6	2
6	55	F	146	70	32.8	ABDO	2	11	7	3
7	31	M	161	81	31.2	NEURO	2	7		3
8	38	M		72		SPINE	2	12	8	3
9	74	M	162	75	22.1	HEART	3	11	4	1
10	46	F	160	70	27.3	NEURO	2	13		3
11	66	M	163	76	28.6	HEART	2	15	4	3
12	35	F	158	71	28.4	NECK	2	13	8	1
13	51	F	146	92	43.2	ABDO	2	15		3

14	51	M	163	82	30.9	HEAD	1	8	8	
15	50	F	156	90	37	ABDO	1	15		3
16	46	M	148	58	26.5	BREAST	2	8		3
17	62	M	175	83	27.1	SPINE	2	13	12	3
18	37	M	164	55	20.4	SPINE	1	11	7	3
19	56	M	169	83	29.1	SPINE	2	11	4	2
20	61	F	141	51	25.7	NECK	2	10	8	1
21	36	F	160	70	27.3	NECK	2	7		1
22	54	F	154	85	35.8	ABDO	2	11	6	2
23	58	M			30.3	ABDO	2	13	3	2
24	64	F	150	64	28.4	HEAD	1	13	4	3
25	76	M	170	76	26.3	SPINE	2	13	4	3
26	51	M	171	100	34.2	SPINE	2	13	12	3
27	38	M	168	95	33.7	RENAL	2	11	3	2
28	48	M	158	55	22	SPINE	1	7		3
29	51	F	145	55	26.2	NECK	2	13	10	3
30	65	M	171	78	26.7	NEURO	2	13	6	2
31	49	M	160	86	33.6	RENAL	1	11	3	1
32	46	M	152	57	24.7	ORTHO	1	8	11	3
33	34	M	174	77	25.4	NEURO	2	11	6	2
34	59	M	178	74	23.4	SPINE	2	13	4	3

35	48	M	165	65	23.9	SPINE	2	8		
36	59	F	144	67	32.3	SPINE	2	13		
38	48	F	155	78	32.5	HEART	3	11	10	2
39	53	M	174	85	28.1	NECK	2	8	10	3
40	42	M	163	80	30.1	ABDO	1	11	7	3
41	39	F	152	80	34.6	NEURO	2	11	4	2
42	54	M	164	83	30.9	NEURO	1	10	4	3
43	51	F	160	90	34	ABDO	1	11	4	1
44	65	M	171	100	34.2	HEART	3	16	12	3
45	31	F	150	55	24.4	ORTHO	2	11	4	3
46	39	F	154	65	27.4	HEART	1	2	4	1
47	55	M	178	101	31.9	ABDO	2	13		2
48	73	M	174	63	22.1	HEAD	1	6	5	2
49	47	F	158	60	24	SPINE	2	11	3	2
50	33	F	155	85	35.4	HEAD	2	7	4	3
51	53	F	142	50	24.8	NEURO	2	8	3	1
52	27	M	165	79	29	NEURO	1	7		2
53	42	M	158	63	25.2	NECK	1	13	9	3
54	57	M	150	56	24.9	HEART	3	15	4	2
55	81	M	170	77	26.6	SPINE	2	8	12	3
56	34	M	165	55	20	SPINE	1	11	6	3

57	58	M	155	89	37	ORTHO	2	13	6	3
58	44	M	168	55	17.7	ABDO	1	12		3
59	73	F	169	78	27.3	ENT	1	8	6	3
60	70	M	162	61	23.2	ABDO	2	11	3	1
61	55	M	162	85	32.4	ABDO	2	11	11	3
62	55	M	163	77	29.1	SPINE	2	7	6	2
63	63	M	158	64	25.6	NECK	2	9		3
64	42	M	165	69	25.3	NECK	1	8		3
65	38	F	160	55	21.5	SPINE	1	7	7	2
66	18	M	143	62	30.3	NEURO	1	9	3	1
67	57	M		74		SPINE	2	16	4	2
68	48	F	155	58	24.1	ORTHO	1	8	4	3
69	82	F	145	44	20.9	RENAL	2	12		3
70	41	M	172	79	26.7	SPINE	1	7	3	2
71	50	M	151	43	18.9	ENT	1	7	4	2
72	26	M	176	86	27.8	NEURO	1	7		3
73	33	F	149	53	24	NEURO	1	11	11	3
74	45	M	163	61	23	SPINE	1	7	3	3
75	75	M	146	54	25.3	ABDO	2	16	4	3
76	59	M	161	68	26.2	ENT	1	11	6	3
77	40	M	162	76	29	RENAL	1	11	12	3

78	61	M	170	70	24.2	SPINE	1	7	3	3
79	47	M	170	74	25.6	RENAL	1	7	3	2
80	76	M	160	63	24.6	ABDO	2	16	14	3
81	71	F	155	50	20.8	ORTHO	2	11	4	3
82	67	M	161	39	15	ABDO	1	11	4	3
83	54	M	156	70	28.8	SPINE	2	11	5	1
84	48	M					1	11	3	2
85	24	M	153	55	23.7	RENAL	1	10	5	3
86	59	M	166	74	26.9	SPINE	2	13	3	2
87	33	F	162	89	33.9	NEURO	2	11	3	1
88	54	F	157	40	16.2	NECK	1	7	10	3
89	59	M	160	62	24.2	NEURO	2	7	12	3
90	64	M	160	64	25	HEAD	2	7	3	1

IDS	time to visualise SECS	time to intubate SECS	was sat maintained yes=1/ no =2	how long was there desaturation (min)	Where was the trauma	how was trauma managed 1= conservative 2= surgical	Difficulties yes = 2 no=1
3	3	10	1		0	0	2
5	17	45	1		0	0	2
3	5	45	1		0	0	1
4	15	30	1		0	0	1
6	8	20	1		0	0	1
2	15	45	1		0	0	1
5	12	65	1		8	1	2
4	10	50	1		0	0	1
5			1		3	1	2
3	8	45	1		0	0	1
3	3	90	1		0	0	2
4	15	30	1		0	0	1
3	20	70	1		0	0	1
2	30	60	1		0	0	1

5	15	65	1		0	0	1
3	12	48	1		0	0	1
2	7	27	1		0	0	1
4	35	51	1		0	0	1
2	5	40	1		0	0	1
4	15	57	1		0	0	1
4	13	47	1		0	0	1
3	25	40	1		0	0	1
4		40	1		0	0	1
7	90	65	1		0	0	2
6	10	66	1		0	0	2
6	33	50	1		0	0	1
5	5	55	1		0	0	1
3	10	30	1		0	0	1
5	15	30	1		0	0	1
3	30	82	1		0	0	1
3	30	40	1		0	0	1
3	5	20	1		0	0	1
3	22	70	1		0	0	2
3	10	40	1		0	0	1
3	10	10	1		0	0	1

3	5	7	1		0	0	1
5	60	60	1		1	1	2
6	10	35	1		0	0	1
6	6	63	1		0	0	1
4	5	10	1		4	1	1
4		60	1		1	1	1
7	7	35	1		0	0	1
7	3	26	1		0	0	1
8	60	20	1		0	0	1
4	45	75	1		0	0	1
2	3	20	1		0	0	1
5	33	72	1		0	0	2
5	6	40	1		0	0	2
3	15	50	1		0	0	1
4	10	50	1		0	0	1
4	15	90	1		0	0	1
4	5	12	1		0	0	1
3	15	40	1		0	0	2
3	40	120	1		0	0	1
2	20	15	1		0	0	1
5	5	40	1		0	0	1

3	6	28	1		0	0	1
3	10	60	1		0	0	1
4	50	30	1		0	0	1
5	20	45	1		0	0	1
3	21	45	1		0	0	1
4	5	35	1		0	0	1
3	5	30	1		1	1	2
4	60	60	1		0	0	1
5	40	100	1		0	0	1
3	13	53	1		0	0	1
3	5	36	1		1	1	1
5	60	113	1		8	1	2
3	10	70	1		0	0	1
3	19	34	1		0	0	1
2	15	20	1		0	0	1
2	14	39	1		0	0	1
4	20	40	1		0	0	1
6	40	44	1		0	0	2
5	20	28	1		0	0	2
3	12	26	1		0	0	1
5	30	60	1		0	0	1

2	10	30	1		0	0	1
5	30	30	1		0	0	1
6	20	27	1		9	1	2
4	10	30	1		0	0	1
6	60	150	1		0	0	1
5	22	52	1		1	1	2
4	10	10	2	1	0	0	1
4	20	10	1		0	0	1
3	40	77	1		0	0	1
8	10	90	1		0	0	1
2	15	35	1		0	0	1
3	10	15	1		0	0	1

poor view yes=1 no=2	inability to direct tube towards the cords yes=1 no=2	less working space yes=1 no=2	unable to maintain scope in the midline yes=1 no=2
2	2	1	1
2	2	2	2
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